the OIL AND GAS JOURNAL

PUBLISHED WEEKLY JUNE 22, 1959

TOLL ROADS

... a big gamble for oil marketers ▸ 68

Going abroad? Why not try offshore? ▸ 65

North Africa's oil patch is growing ▸ 85

Drill-stem tests—success or failure? ▸ 106

Empire Abo—New Mexico's latest target ▸ 148

New Areas - Agreements for IRAN

p. 90

"Calling the Signals...for Safety"

Safety on the job begins with the men you see here, "huddled" to plan every move and action they will take in executing their individual tasks. Checking and re-checking details of the job to be performed, with every man knowing exactly what is expected of him... when, where, and how... leads to the type of teamwork that makes *safety a reality*. When the "play is called" on your job, every Halliburton man is prepared to follow the safety rules that lead to better performance, and better results. For safety on your next job... let Halliburton "Call the Signals."

HALLIBURTON OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
June 22, 1959

Oil men are set to weather a 2-months' steel strike:

Supply people confidently report their stocks can protect necessary industry operations for 7 to 8 weeks—maybe even longer.

Their estimate of the situation: If United Steelworkers walk out on July 1 and stay out past Labor Day, the oil man will feel the steel pinch. Any shorter strike will have only minor repercussions.

That's also the case of most industry. Steel sources say few steel consumers will be hurt for a month. After 6 weeks, many steel users will be hurt by unbalanced stocks. A 2-months' strike would force mass shutdowns.

Oil's buying trends this year have run like this, according to the suppliers:

Heavy orders in first quarter, chiefly to replace depleted inventories and prepare for possible strike.

Only normal buying in last 60 days with majority of oil operators ordering delivery right to the site. Fear of strike just hasn't caused any unusual flurry of buying as the showdown time nears.

One possible tight spot: Smaller sizes of tubing and pipe, especially 2½ to 4-in. tubing, are short. Mills haven't been turning out large volumes of these sizes, concentrating more on the larger sizes.

▼ ▼ ▼

It's hard to become over optimistic these days.

On the brighter side, are two speakers before the compact session in New Orleans:

Imports Chief Carson says the control program already has begun to show results in improved industry conditions. He cites improved drilling and completion rates.

Minor Jameson, IPAA executive vice president, forecasts a 400,000-bbl. daily increase in domestic crude demand in fourth quarter. This is based on import quotas announced for the second half.

Add to this the new gains in rotary rigs working. Latest count put them at 2,280, a gain of 114 in last 2 weeks and 446 higher than at this time last year.

The Oil and Gas Journal is published weekly with an additional issue in January by The Petroleum Publishing Co., 211 S. Cheyenne, Tulsa 3, Okla. Second-Class postage paid at Tulsa, Okla. Copyright 1959 by The Petroleum Publishing Co. United States and foreign rates to the petroleum industry, 1 year $5, 2 years $8, 3 years $10.

Taking the edge off this optimistic outlook:

...Producers' income is static or falling. Production is down as buyers cut back to adjust for lower refinery runs. Adding to this is Texas' 9-day production pattern for July. The slowdown is prompted by high product stocks and softening prices. Some crude—especially on the Gulf Coast—is being hit by price cuts.

...Oversupply of crude is still a specter despite import controls. Witness Louisiana's warning to operators to slow up development drilling and plea before compact by Oklahomans for market-demand proration in all states. Oklahomans claim the states with no conservation laws or oil regulations are reaping the big benefits from import controls. They fear further market disruptions may bring on full federal control.

...Profit margins on rigs working still aren't good, say the drilling contractors. Their report: It doesn't matter how many rigs are running. If they're not earning a fair return, the industry is fooling itself with false activity.

▼ ▼ ▼

Determination to stick to their knitting is apparent among members of the Interstate Oil Compact Commission. They want to confine activities closely to objectives of the compact's charter.

Two votes at New Orleans meeting showed the trend:

...Imports-study committee work terminated on grounds that it has completed its job in reporting on effect of imports on state conservation programs.

...Amendments to model conservation statute to include regulation of common purchasers, common carriers, and drilling bonds rejected by legal committee.

Both actions reflect a desire to avoid "trust" charge.

Don't look for trial to start in Tulsa before next January for 29 oil firms indicted on price-fixing charges.

That's prediction of U. S. District Judge Royce H. Savage who'll try the case without a jury.

Judge Savage last week ruled, in effect, the Government must get more particular in its bill of particulars. He told federal lawyers to spell out their charges in more detail by August 15. First of several pretrial conferences now is set for September 9.

▼ ▼ ▼

A new drilling rule-of-thumb:

It's cheaper to drill offshore in many parts of the world than to look for oil onshore.

That's the thesis of ODECO President A. J. Laborde. He claims economies are realized offshore by cheaper transportation, easier supply sources, better operating conditions. Also if the well's a failure, the operator can pull up and move off without leaving a fortune in equipment.

Laborde's thesis is based on a successful drilling campaign in Mexico's Bay of Campeche. He admits offshore drilling abroad has some pitfalls and perils to the unwary (p. 65).

Humble is leasing big blocks in south-central Oregon and northern California.

Sources in Portland say Humble has leased 260,000 acres in Lake County, Oregon, alone. Humble confirms its activities but declines to give size of holdings.

Company spokesman says: Survey work has been under way for some time and results are promising. Company wants to have access to this land for further checking, such as seismograph work.

New Spanish oil law is now in effect.

It opens most of Spain—and more important—its African possessions to foreign companies on a more attractive basis.

Companies can hold 100% interest in concessions and the 50-50 profit split is provided.

Week's big exploration news is in:

...Libya where a remote wildcat completed as a 17,500-bbl. daily producer opens up a huge area. Esso Standard's 1 Zelten is at the eastern end of a young oil province that stretches 1,000 miles across North Africa. Geologists now say the region potentially is another U.S. Mid-Continent (p. 85).

...Delaware basin of West Texas where Magnolia found more oil in the Wolfcamp. The 1 Moore in Pecos County now is drilling ahead to the Ellenburger, but the Wolfcamp show is expected to reawaken interest in deep drilling in the basin.

▼ ▼ ▼

Canadian production is headed for new high this year.

It should top 500,000 bbl. daily, says British American President E. D. Brockett (p. 70). He attributes the expected production increase to Canadian exemption from U.S. imports control and growing domestic demand there.

A new economic study, meanwhile, tells Canadian oil men their most attractive outlets on an open U.S. market are Minneapolis, St. Paul, and the Pacific Northwest. Detroit-Toledo is marginal but might be developed. Chicago and Montreal are possibilities only on a price-cutting basis (p. 70).

▼ ▼ ▼

How are oil marketers doing on the turnpikes?

Some are making money—others marginal or losers. The marketing men say the trend is against profitable operations at the swank service centers on the expressways because:

...Royalties exacted by the states are too high.

...Price control efforts are being made by states, and the turnpike centers need an extra price margin because of the super facilities and service offered.

...Engineering estimates on traffic and patronage which governed company bids on spots have proved too optimistic.

...Original investments have been heavy and operating costs high.

Offsetting these factors, however, are several which still make the turnpike spots attractive. The centers have proved good advertising and sales promotion tools and have been used as training ground for sales personnel (p. 66).

New gasoline blends are being forced on Los Angeles refiners in stiffer smog rules adopted by authorities (p. 78).

Law will require olefin content of motor fuels be reduced to 18% by June 30, 1960 and to 12.5% by 1961. Content now is 23%.

Refiners say the result will be:

...$50-million investment in new catalytic-reforming and hydrogenation facilities over next 2 years.

...Added cost of 0.8 of a cent per gallon to motorist.

They say the rule won't solve the smog problem either.

Deliveries of 91-octane regular gasoline have begun at Kansas City and Des Moines terminals of Great Lakes pipeline.

The improved grades will be available at other terminals as stocks of the 89-octane grade are depleted.

▼ ▼ ▼

News from two competitors of oil:

Shale-oil Expert Tell Ertl is trying to raise $20 million to build a 20,000-bbl.-daily plant 20 miles north of Grand Valley in western Colorado. He says he can turn out shale oil for $2 a barrel (p. 72).

Tapping the massive Athabaska tar sand reserves may be nearer than we think—and not by means of the H-bomb. The economics looks fairly good for conventional extraction of asphaltic content of the sands, coking and hydrogen treating the extract on the spot, and pipelining it to existing refineries.

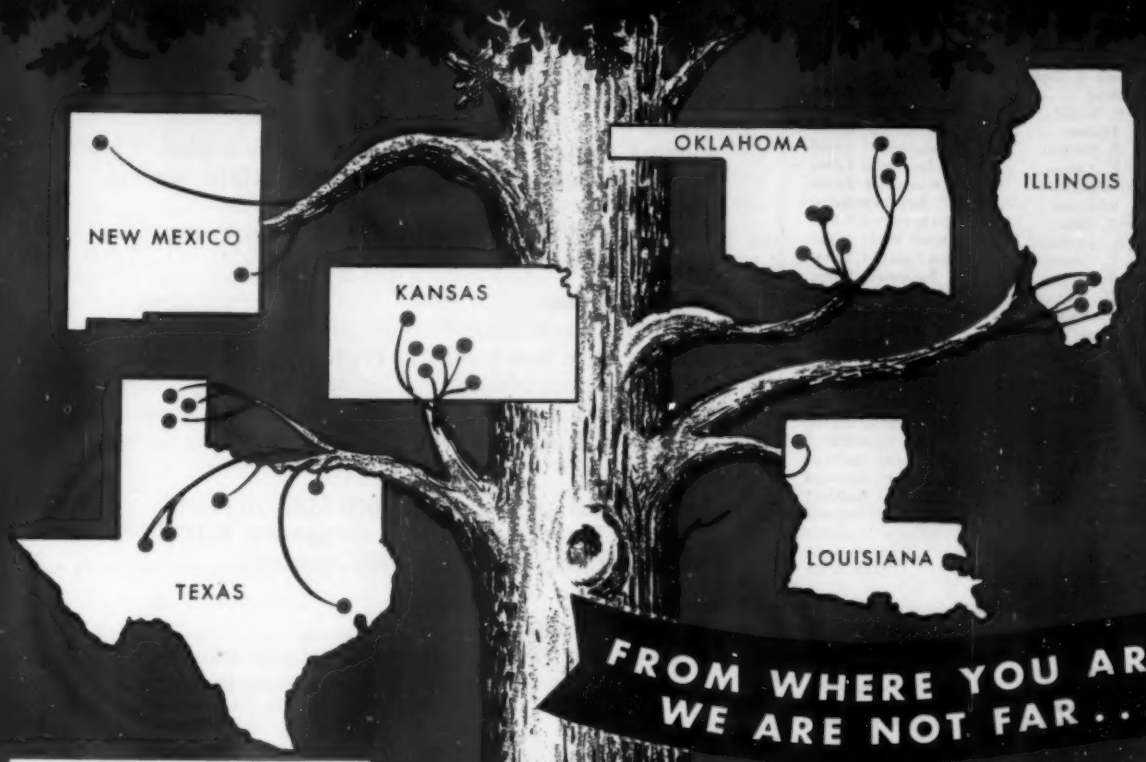
Hydrocarbons from tar sands, according to some experts, lend themselves better to such treatment than oil shales.

But producing both shale and tar sands by nuclear blasts still sets off controversy among oil scientists. Houston petroleum engineers were treated to such a learned argument last week (p. 72).

Dr. Gerald A. Johnson, associate director of Lawrence Radiation Laboratory, defended "Plowshare" program for peacetime uses of atomic energy. Dr. King Hubbert, consultant and member of National Academy of Sciences, called on oil men to wake up to threat to humanity from dangers of the blasts.

GROWING WITH THE OIL INDUSTRY

28 OFFICES AND STORES IN 6 STATES



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IN THE NEWS

General Interest:
Trends Show Small Profit in Toll-Road Marketing 68
Future Canadian Oil Markets Cited in New Report 70
Sharp Nuclear Debate Set Off at Houston AIME Meeting 72
Photos in the News 74
Western Natural Buys Premier Oil Refining 78
Eastern States Wins Temporary Import Hike 81

Drilling-Production:
Economics Look Good for Foreign Offshore Drilling 65
B-A President Sees Canadian Production Record in '59 70
Oil Men Discuss Methods to Combat Oversupply 76
California Is Reopening Shut-In, Low-Gravity Wells 78
Texas Slashes Allowable to 9 Days for July 82

Foreign News:
Libyan Finds Add Luster to 1,000-Mile Oil Patch 85
Iran Puts New Acreage Up for Competitive Bids 86
Ras Tanura Is Middle East Oil Crossroads 88

Processing:
Processing Briefs 76
Socony Mobil Designs New Vapor-Inlet Distributor 79
Sohio Research Develops New Acrylonitrile Process 80

Exploration:
New Tandem Tractor Aids Oil Hunt in Canada's Muskeg 67
O'Mahoney Leasing Bill Would Protect Fraud Victims 79
Skelly Hits Twice in Kansas-Nebraska Area 147
New Mexico's Empire Abo Field Sparks Drilling Play 148
More Production for Oklahoma's Beaver County 152
Wildcatters Due for Busy Summer in British Columbia 158
Texas Panhandle Sets Fast Wildcatting Pace 159

Pipelining:
Midwestern Awards Contracts for Big-Inch Gas Line 73
Pipeline Briefs 82

Next Week:

Special Report on Gas Turbines

TEN YEARS AGO, the oil and gas industry's first experimental gas turbine was installed. Today, installations exceed 1,500,000 hp.

This rapid growth will be spotlighted in a special report in the Journal's June 29 issue. Watch for these exclusive features:

- World-wide survey listing gas-turbine installations in the pipeline, refining, producing, and petrochemical industries.
- The world's largest gas turbine on a pipeline.
- Gas-turbine design and waste-heat recovery.

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TECHNOLOGY–OPERATION

Exploration

Geology and Prospects of New Areas in Iran **90**

By G. E. Crays, G. W. Underwood, and T. B. Young

Iran has recently declared three large areas, Districts 8, 14, and 18, available to foreign capital for operating agreements. Iran is often called a geologist's paradise, with almost a complete geological column from Precambrian to Recent, outcropping at the surface in a wide variety of rapidly changing facies, and a complex tectonic pattern, with sharp folding as late as Quaternary in some localities. Three types of operating agreements are available in Iran, and these are described.

Drilling-Production

How We Can Improve Drilling Operations **97**

By T. B. O'Brien and J. K. Butler

Here are comments from a discussion presented to the South Texas Section of ASME at Houston. Hydraulic systems are being improved. Drill-string design is far ahead of field practice. Maximum use of lightweight drill pipe can reduce cost in several ways. Better bits are coming.

Drill-Stem Testing—Success or Failure? **106**

By Jack Grynberg

This may largely depend on your ability to differentiate between formation water and mud filtrate. A watchful and rational approach in evaluating drill-stem, formation-fluid sampler, and production-test data would eliminate the bypassing of commercial reservoirs from which water that is real mud filtrate is recovered. It is believed that poor evaluation of test results has caused bypassing of numerous commercial fields.

Refining-Processing

Sulfide Scaling Under Hydrofining Conditions **102**

By W. H. Sharp and E. W. Haycock

Part 3 of three parts. This installment is devoted to the prediction of long-term corrosion rates. The first two installments covered a description of test equipment and procedures, a discussion of the process variables, and corrosion by organic sulfides.

Process Costimating **125**

Refinery jobs and wage rates—Part 2 of two parts.

Air Cooling in Petrochemical Plants **128**

By R. T. Matthews

The chemical industry is lagging in adopting air-cooled exchangers. Unusual problems are encountered in applying these units to chemical plants but solutions can be found. Usually if 75% of the heat can be removed above a 25° F. approach and allocated costs for water facilities are $50 per g.p.m. or higher, air-cooled exchangers offer attractive possibilities.

Pipelining

Spheroids Separate Batches in Products Pipeline **116**

By M. L. Barrett, Jr.

Part 2 of two parts. Expandable elastomer spheroids placed at properly spaced intervals in the interfacial mixture between incompatible products will minimize and control interfacial mixing. The technique is being developed on Shell's 14-in. 250-mile Wood River-Chicago products line.

DEPARTMENTS

Advertisers' Index	175	Equipment Men in the News	140	Process Costimating	125
Book Review	105	Exploration Highlights	147	Production	168
Calendar of Events	55	Foreign News	85	Refining Statistics	169
Classified Advertising	171	Journally Speaking	61	Statistical Summary	166
Drilling Contractors	145	Markets	170	They Say	51
Drilling Statistics	167	New Equipment	132	Trade Literature	138
Editorial	63	Personals	162	Watching Washington	73

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Swift tides and pounding waves make *flexible* offshore lines mandatory. To fill these requirements, producers turn to Chiksan Swivel Joints. Chiksan Joints in submerged service safely handle all maximum operating and surge pressures and provide the right degree of line flexibility to meet any tide and wave conditions. Moreover, Chiksan Joints are designed for salt water service and years of attention-free performance is common. Chiksan Joints and their partner Weco Unions are sold by leading supply stores everywhere.

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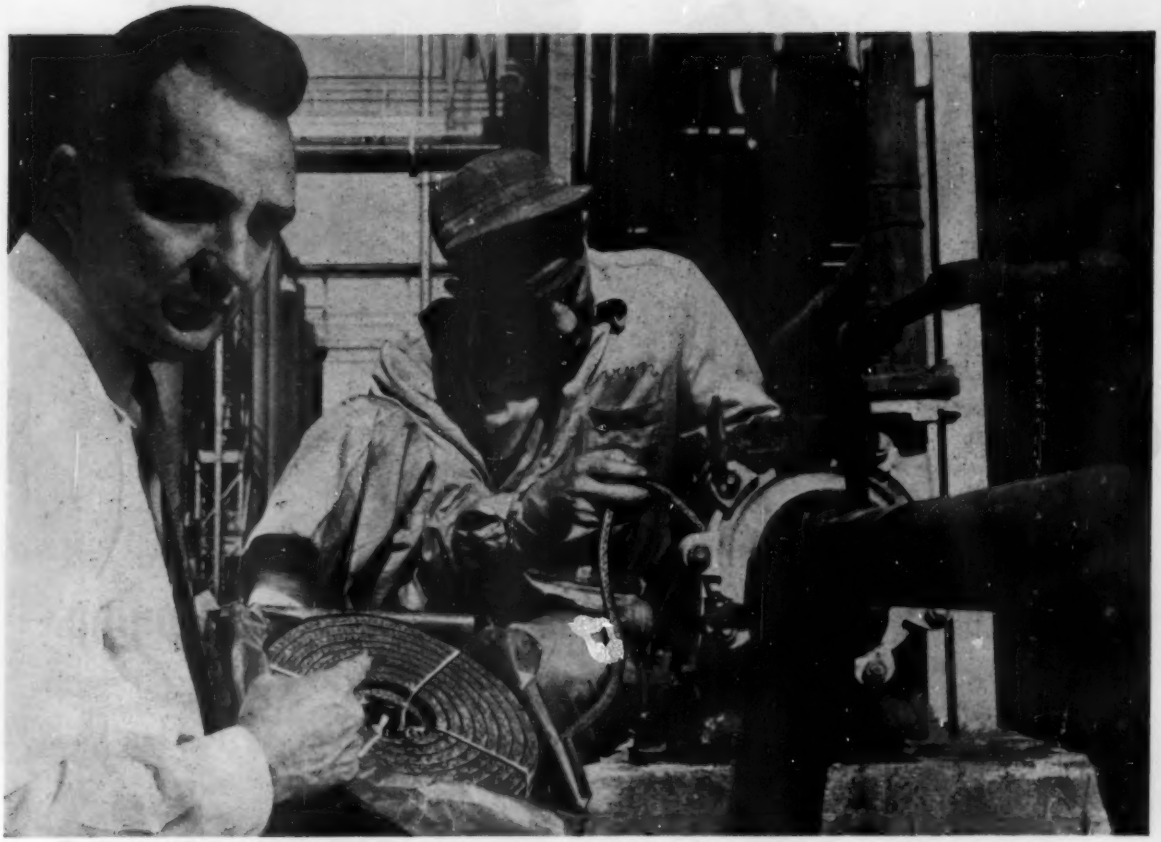

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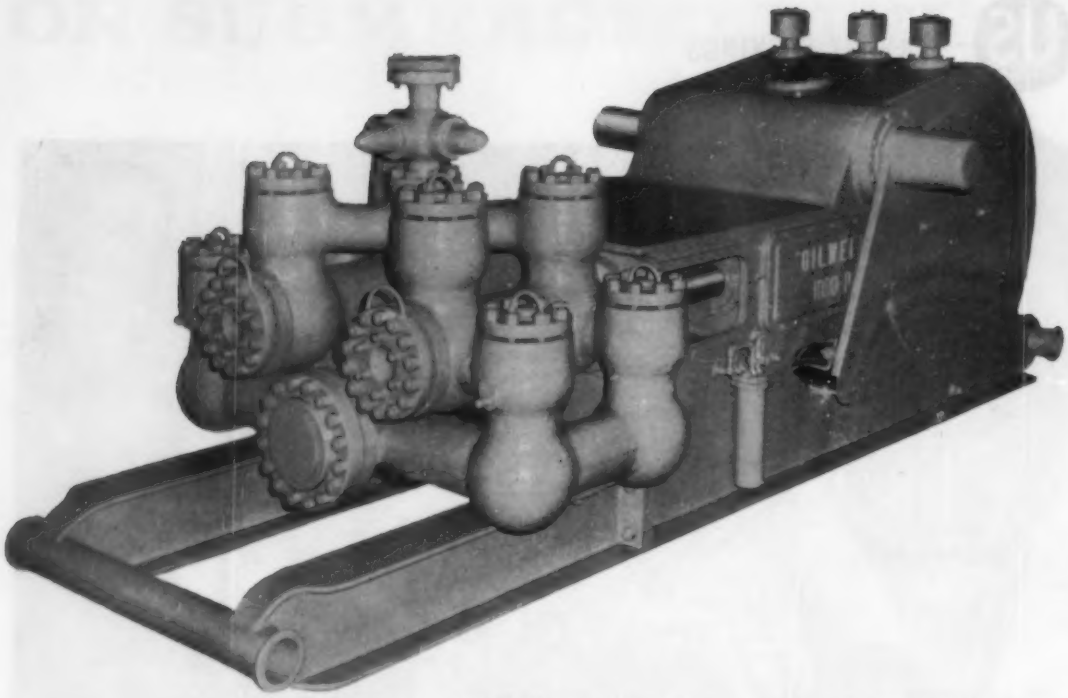

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6½	2,480	270	360	450	540	585
6¾	2,275	295	395	490	590	640
7	2,100	320	425	535	640	695
7¼	1,940	345	460	580	695	750
7¾	1,675	400	535	670	805	870
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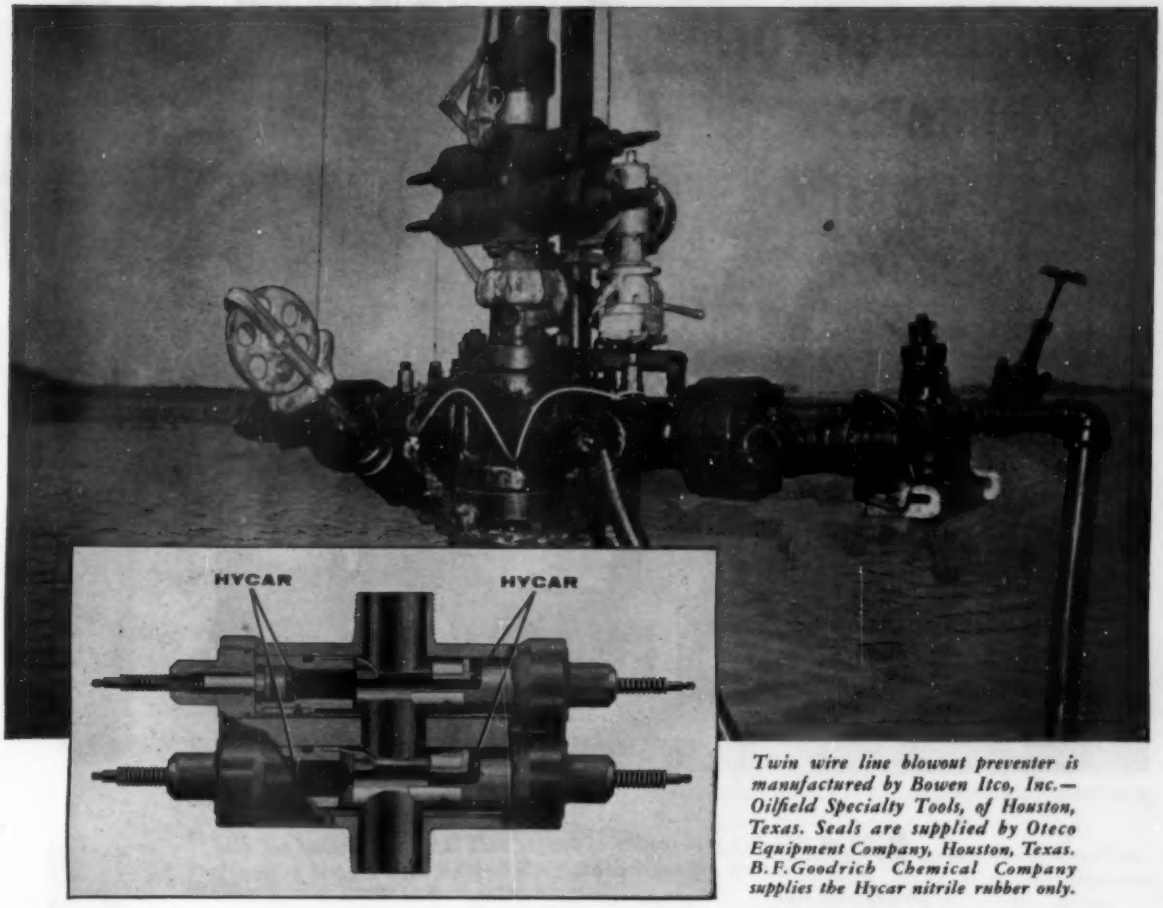

Twin wire line blowout preventer is manufactured by Bowen Itco, Inc.—Oilfield Specialty Tools, of Houston, Texas. Seals are supplied by Oteco Equipment Company, Houston, Texas. B.F.Goodrich Chemical Company supplies the Hycar nitrile rubber only.

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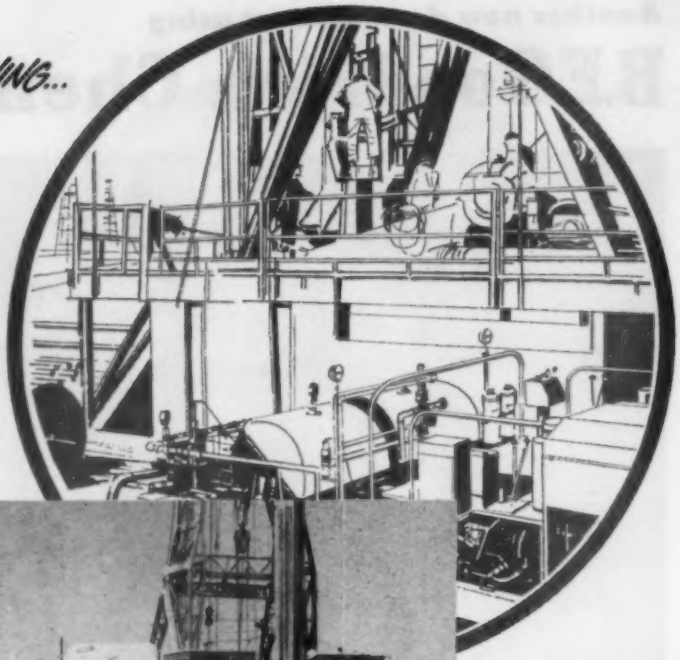

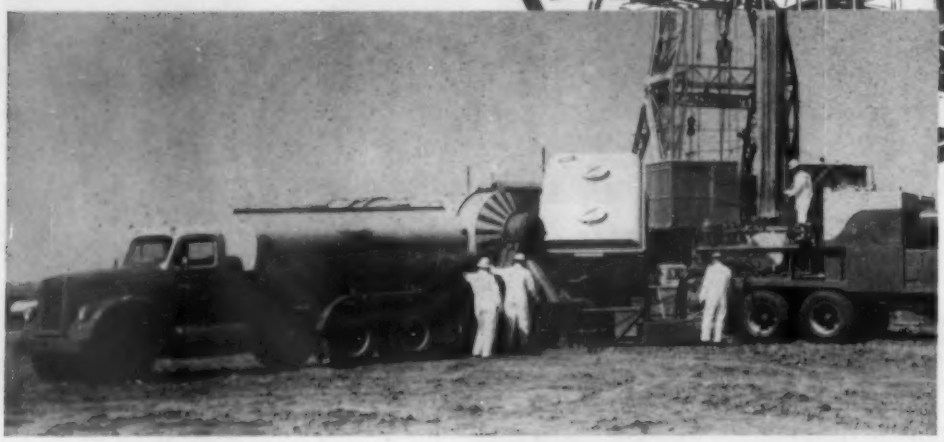

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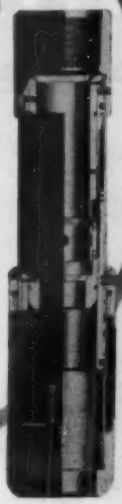

FORMATION PACKER SHOE

Installed on the first joint of a string of casing, it offers many advantages. This shoe is used in all areas where conditions require casing to be set on top of the producing formation, because:

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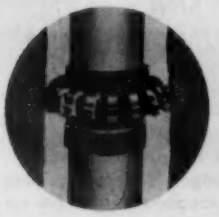
- Packer Shoe provides circulation of fluids through end of Shoe until shoe packer rubber is expanded and set.

FORMATION PACKER COLLAR

Installed on casing above the shoe joint, it helps protect a lower formation from contamination during cementing. Several joints of casing or liner may be installed on lower end of packer collar; the packer is set and cement pumped down casing and out into annulus above expanded packer.

FULL-FLOW PACKER SHOE

A packer-type cementing shoe to help protect the formation below while cementing tubing or casing in new or old cased or uncased wells. No internal parts remain in the string to be drilled out upon completion of the cementing operation... Danger of drilling fluid damage is reduced... Particularly suitable for small tubing strings.



RECIPO WALL CLEANER

Removes filter cake from wall of bore hole to allow better bonding of cement to formation and casing.

- Flexible, tough rubber fingers minimize bore hole or filter cake damage while running casing, yet are sufficiently rugged to thoroughly clean wall when casing is reciprocated.
- Wide cleaning fingers clean broader area of bore hole wall. Aid in breaking up channeling of cement.
- Wide fluid passage areas between rubber cleaning fingers help reduce circulating pressures and bridging action of filter cake cuttings.
- Hinged type design permits fast, easy installation on casing.
- Cleaning fingers do not bend into permanent distortion.

CEMENTING SERVICES

284 SERVICE CENTERS...

JUST MINUTES AWAY FROM YOUR RIG

FRANKS *Explorer* "Rocket"

CHECK FRANKS EXPLORER BEFORE YOU BUY

More Usable Power

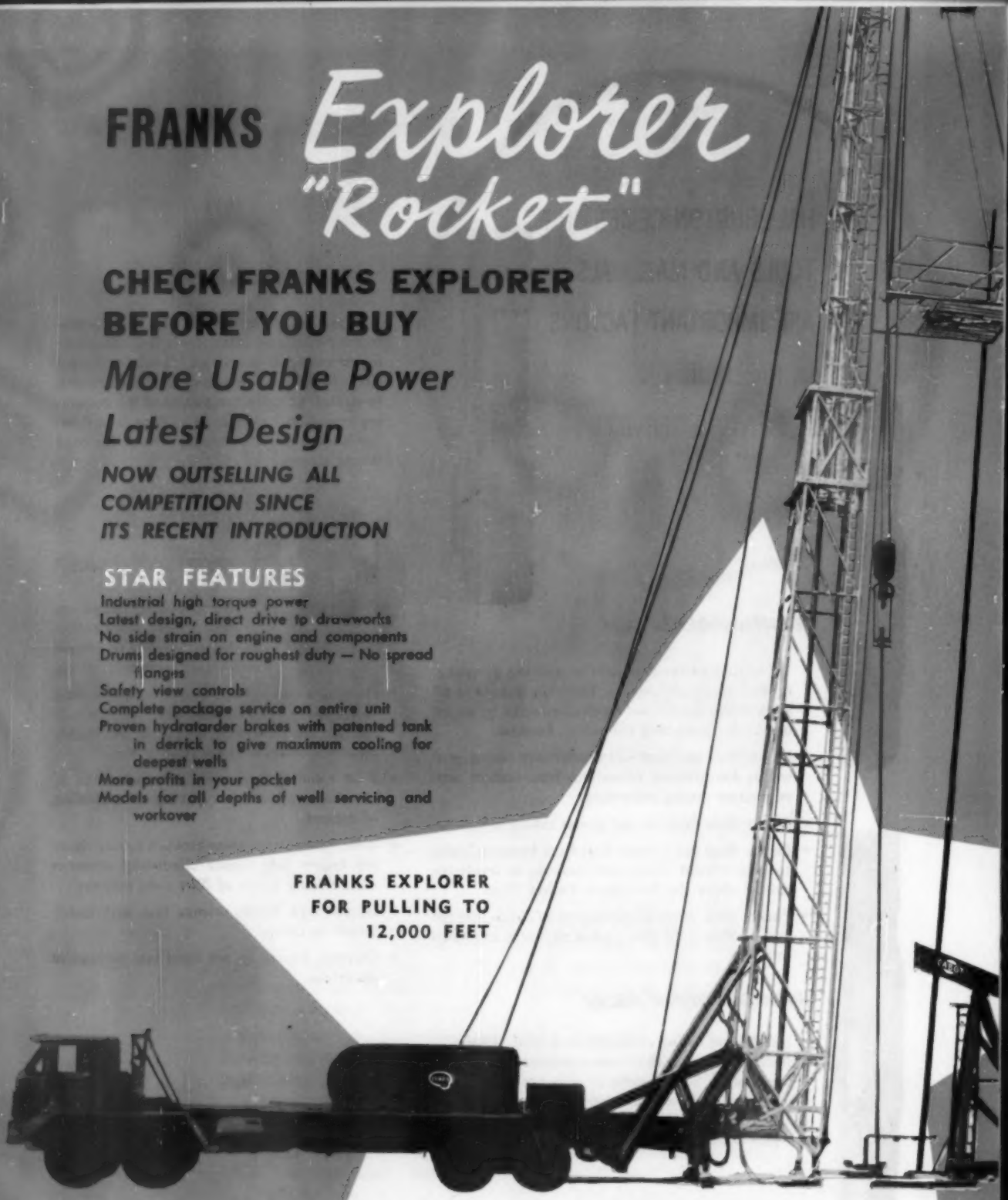
Latest Design

NOW OUTSELLING ALL COMPETITION SINCE ITS RECENT INTRODUCTION

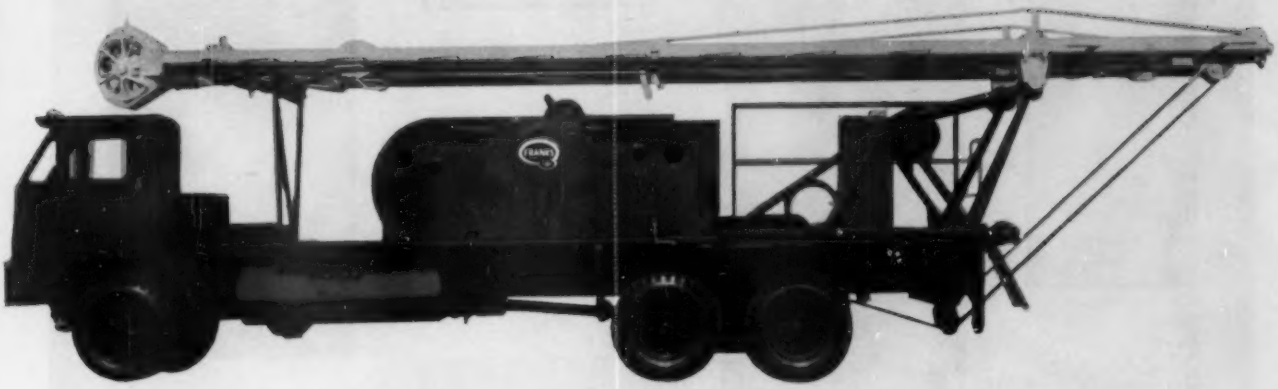
STAR FEATURES

Industrial high torque power
Latest design, direct drive to drawworks
No side strain on engine and components
Drums designed for roughest duty — No spread flanges
Safety view controls
Complete package service on entire unit
Proven hydratarder brakes with patented tank in derrick to give maximum cooling for deepest wells
More profits in your pocket
Models for all depths of well servicing and workover

FRANKS EXPLORER FOR PULLING TO 12,000 FEET



Explorer "Cruiser"



STAR FEATURES

The most popular and widely accepted servicing unit in the field. Eight models, single or double pole masts. All balanced capacities to 12,000 feet.

- The pace setter . . . widely imitated but not duplicated
- New main drum design
- New hardened and removable brake rims
- New main drum brakes, water and air cooling system
- New power take-off oil bath chain drive
- Removable sand reel
- Full air clutches
- Single or double pole telescoping masts
- Hydraulic drive for power tongs and rotating workover heads

WELL SERVICING AND DRILLING UNITS

FRANKS

DIVISION OF

CABOT

PAMPA, TEXAS

Again last year Texas employers bought more
workmen's compensation insurance from
TEIA than from any other company.
No finer endorsement is possible.
TEIA
TEXAS EMPLOYERS' INSURANCE ASSOCIATION
First with Texas Industry for 46 years
Home Office: Dallas | 28 Service Offices in Texas | Austin F. Allen, Chairman of the Board | Ben H. Mitchell, President

Designed with exact

WEIGHT-HORSEPOWER RATIO *for maximum performance*

Now there are seven different sizes of Continental-Emsco D-Series slush pumps . . one to match every rig requirement. They are an engineering milestone in combining the horsepower necessary for volume and pressure demands of modern drilling with a weight that makes transporting and handling around the rig site easy and economical . . even in remote oil fields of the world.

FABRIFORM CONSTRUCTION Gone are the bulky single iron castings. In their place are smooth, modern steel sheets and shapes welded together into a strong, rigid light weight frame.

HERRINGBONE GEARS Here again, weight is saved and compactness gained by design . . without sacrificing strength and power. Wide-faced, forged-steel, heat-treated herringbone gears provide quiet and efficient speed reduction. Forged, high-alloy steel pinion and pinion shaft are integral . . fully heat treated for maximum strength and resistance to wear.

ECCENTRIC ASSEMBLY Other features which add compactness to these pumps are: (1) use of a one-piece steel eccentric hub with gear mounting, eccentrics and main shaft integral; and (2) large diameter narrow eccentric roller bearings.

"EXPOSED" LINERS With this patented construction feature, packing leaks can be spotted immediately and stopped before fluid end is washed out. Liners cannot become "sanded-up" in the cylinder bore.

LUBRICATION Practically running in oil, all moving parts are flood lubricated by a positive splash lubrication system for less friction and longer operating life. Troublesome grease fittings and lubricators are eliminated.

NEW CONTINENTAL-EMSCO SLUSH PUMP SIZES

WITH

FIELD PROVEN DESIGN

Designed with exact
WEIGHT-HORSEPOWER RATIO *for maximum performance*

Now there are seven different sizes of Continental-Emsco D-Series slush pumps . . one to match every rig requirement. They are an engineering milestone in combining the horsepower necessary for volume and pressure demands of modern drilling with a weight that makes transporting and handling around the rig site easy and economical . . even in remote oil fields of the world.

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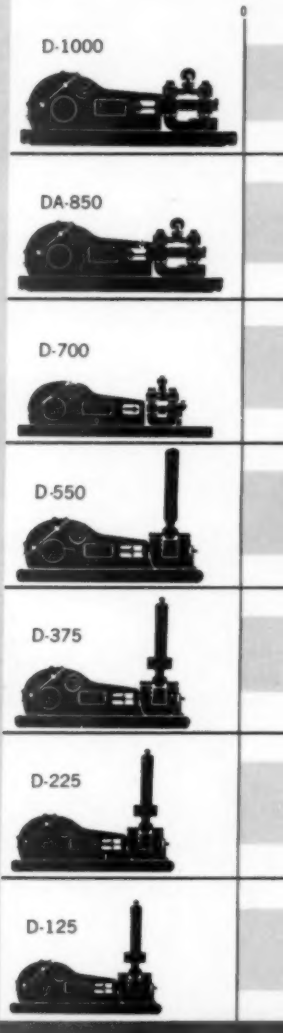
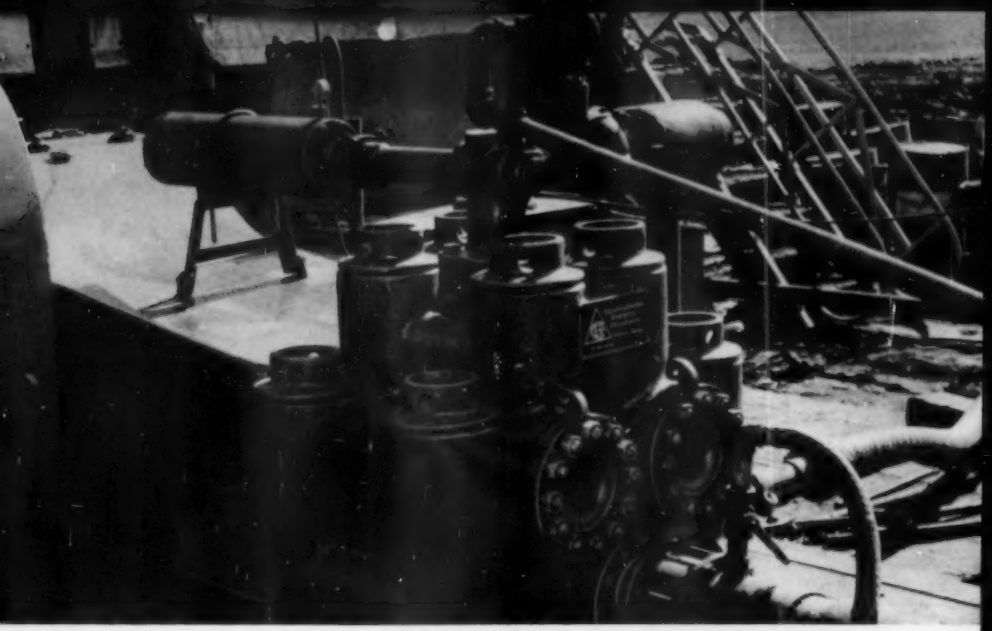
POWER, PR



For Service that



PRESSURE, VOLUME FOR EVERY RIG REQUIREMENT..

POWER INPUT RATING (HORSEPOWER)

0 100 200 300 400 500 600 700 800 900 1000

MAXIMUM INPUT — 1000 hp @ 60 spm
VOLUME — MAXIMUM SIZE LINER (8¼") — 933 gpm
PRESSURE — MINIMUM SIZE LINER (5¾") — 3,480 psi

MAXIMUM INPUT — 850 hp @ 60 spm
VOLUME — MAXIMUM SIZE LINER (8¼") 933 gpm
PRESSURE — MINIMUM SIZE LINER (5¾") 2,954 psi

MAXIMUM INPUT — 700 hp @ 65 spm
VOLUME — MAXIMUM SIZE LINER (8¼") 909 gpm
PRESSURE — MINIMUM SIZE LINER (5½") 2,727 psi

MAXIMUM INPUT — 550 hp @ 65 spm
VOLUME — MAXIMUM SIZE LINER (7½") 751 gpm
PRESSURE — MINIMUM SIZE LINER (4¾") 2,915 psi

MAXIMUM INPUT — 375 hp @ 70 spm
VOLUME — MAXIMUM SIZE LINER (7½") 723 gpm
PRESSURE — MINIMUM SIZE LINER (4¾") 1,991 psi

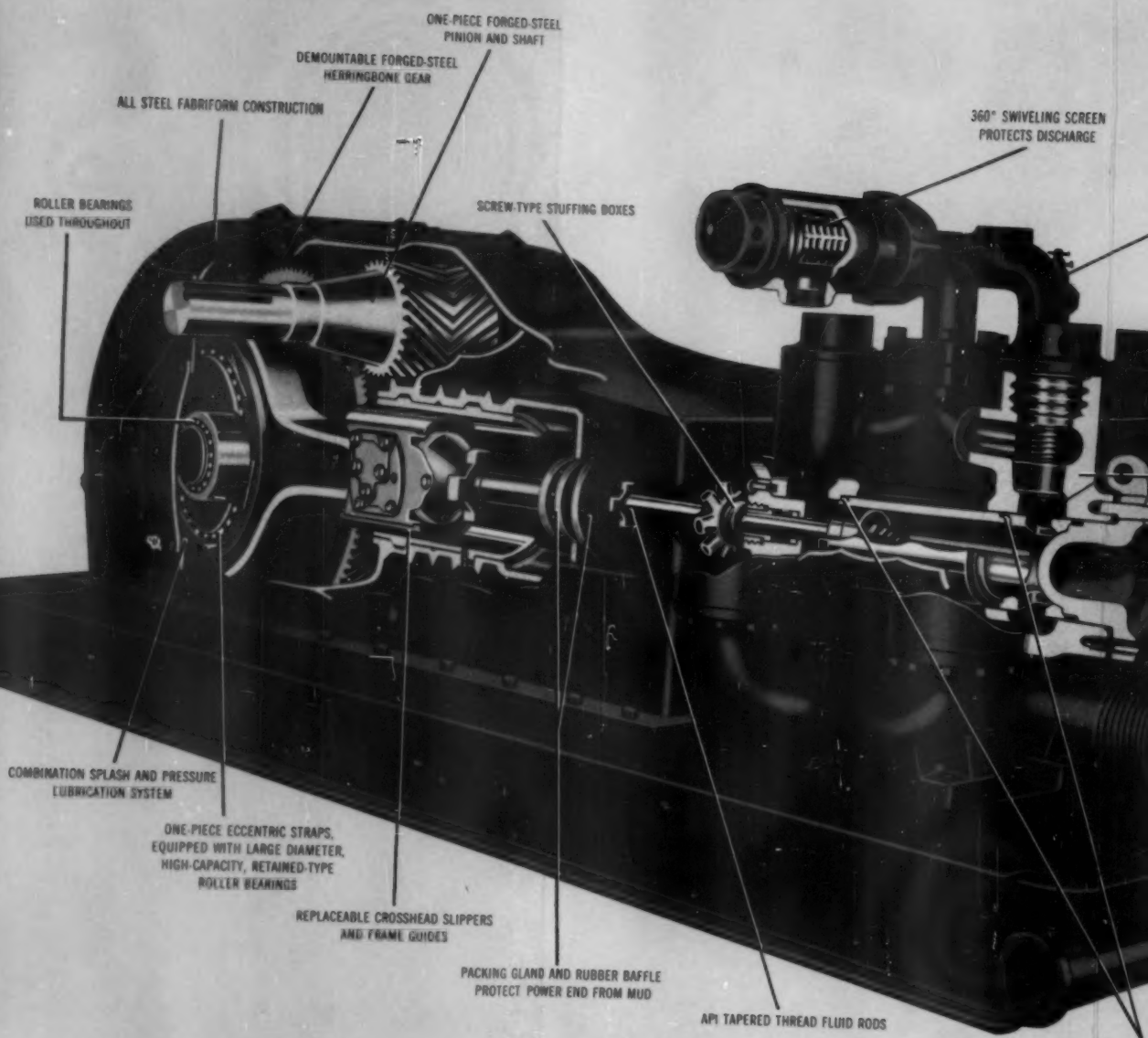
MAXIMUM INPUT — 225 hp @ 70 spm
VOLUME — MAXIMUM SIZE LINER (7¼") 580 gpm
PRESSURE — MINIMUM SIZE LINER (4½") 1,551 psi

MAXIMUM INPUT — 125 hp @ 85 spm
VOLUME — MAXIMUM SIZE LINER (7¼") 590 gpm
PRESSURE — MINIMUM SIZE LINER (4½") 840 psi

at Sings.. Equipment that Hums.. Go **CONTINENTAL-EMSCO!**

Now a Complete Line . . . with FIELD

CONTINENTAL-EMSCO SLU


ONE-PIECE FORGED-STEEL PINION AND SHAFT
DEMOUNTABLE FORGED-STEEL HERRINGBONE GEAR
ALL STEEL FABRIFORM CONSTRUCTION
360° SWIVELING SCREEN PROTECTS DISCHARGE
ROLLER BEARINGS USED THROUGHOUT
SCREW-TYPE STUFFING BOXES
COMBINATION SPLASH AND PRESSURE LUBRICATION SYSTEM
ONE-PIECE ECCENTRIC STRAPS, EQUIPPED WITH LARGE DIAMETER, HIGH-CAPACITY, RETAINED-TYPE ROLLER BEARINGS
REPLACEABLE CROSSHEAD SLIPPERS AND FRAME GUIDES
PACKING GLAND AND RUBBER BAFFLE PROTECT POWER END FROM MUD
API TAPERED THREAD FLUID RODS

PROVEN DESIGN
USH PUMPS

POWER END FRAME

Fabriform construction of power end frame is unique in that it: (1) allows metal to be placed exactly where it is needed to reinforce critical stress areas and to form a strong, light weight frame; (2) permits the use of thin steel plates and shapes in place of bulky, heavy iron castings. Precision machining of the power end frame assures accurate alignment of main shaft, pinion shaft and crosshead bores. All machining operations take place after the power end frame has been completely stress relieved.

FLUID END

Maximum strength is built into this critical part by the use of steel castings, electrically welded into a single unit. Each valve is located in a separate pot or valve chamber for easy access. Threaded valve pot covers are designed to reduce bulk and weight and to speed up valve inspection and replacement. Suction passages are large, direct and smoothly curved to prevent restriction of fluid flow . . even when heavy drilling muds are used. Use of one suction eliminates *dead spaces* which tend to break up a streamline flow.

MANUFACTURED BY

CONTINENTAL-EMSCO

Serving the Oil and Gas Industries ... Worldwide

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RUST-OLEUM®

STOPS RUST!®

and matches ORIGINAL EQUIPMENT

COLORS

Distinctive as your own fingerprint. Accept no substitute.

How much does rusty equipment cost *you*? With Rust-Oleum, you STOP RUST—and you match original equipment colors, too, for long-lasting protection!

We want you to see for yourself how *easy* it is to use Rust-Oleum . . . actually take the brush and see how smoothly it works, how it dries to an *attractive, high-gloss finish* that resists sun, fumes, rain, heat, snow, salt air and salt spray, and blowing dust and sand. And the same formula can be applied by brush or spray. Just check the coupon for the color you want . . . and attach it to your business letterhead for a FREE TEST SAMPLE. No cost or obligation.

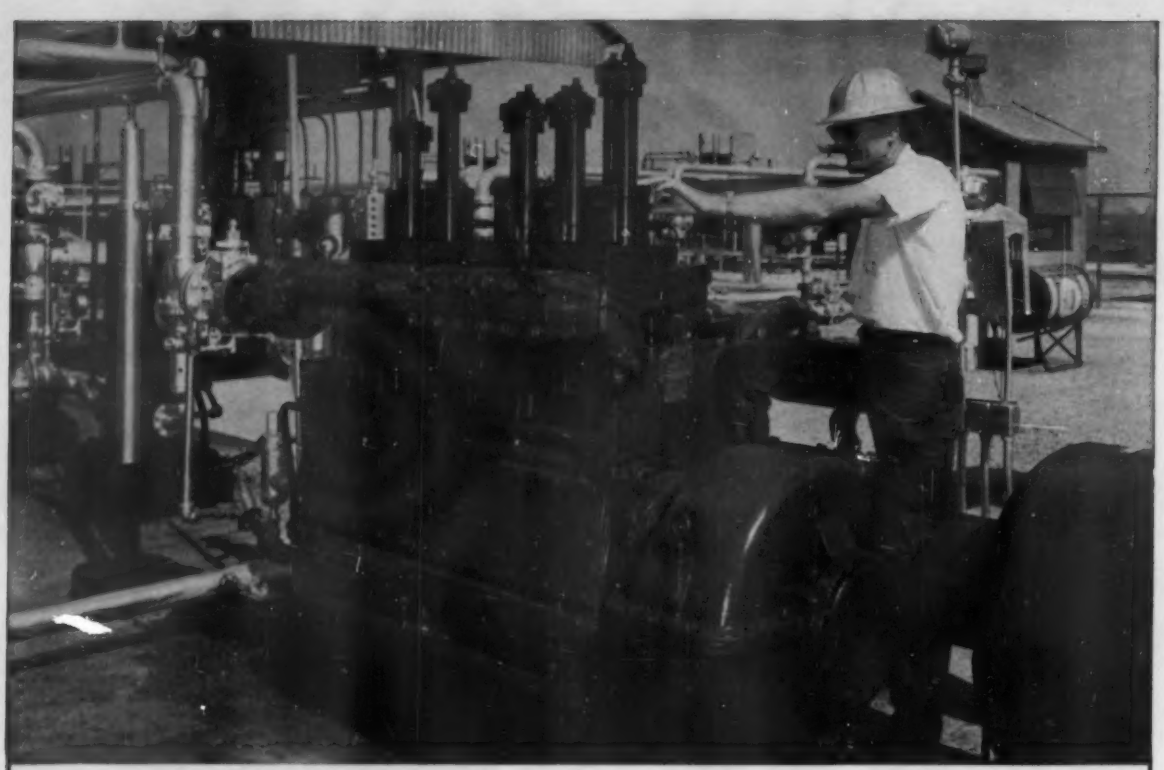
Your Rust-Oleum Distributor maintains complete stocks for immediate delivery.

ATTACH COUPON TO YOUR BUSINESS LETTERHEAD FOR FREE TEST SAMPLE

CHECK COLOR TO MATCH YOUR EQUIPMENT

RUST-OLEUM CORPORATION, 2625 Oakton St., Evanston, Ill.
Please send me a FREE TEST SAMPLE in the color checked.

- ☐ 769 Damp-Proof Red Primer
- ☐ H-50 Primer
- ☐ 634 Quick Drying Black
- ☐ 2766 High Gloss White
- ☐ 470 Ready Mixed Aluminum
- ☐ H-4 Caterpillar Yellow
- ☐ 722 Bethlehem Yellow
- ☐ 728 Old Emsco Green
- ☐ 726 New Emsco Green
- ☐ 727 New Unit Rig Gray
- ☐ 724 Waukesha Gray
- ☐ 725 New National Blue
- ☐ 723 Oil Well Orange



FIELD REPORT

SERVICE: LP-Gas Injection

Burnell—North Pettus Cycling Plant

PUMP: 1½"x5" Aldrich Quintuplex

OPERATION STARTED: June, 1950

EXPERIENCE TO DATE:

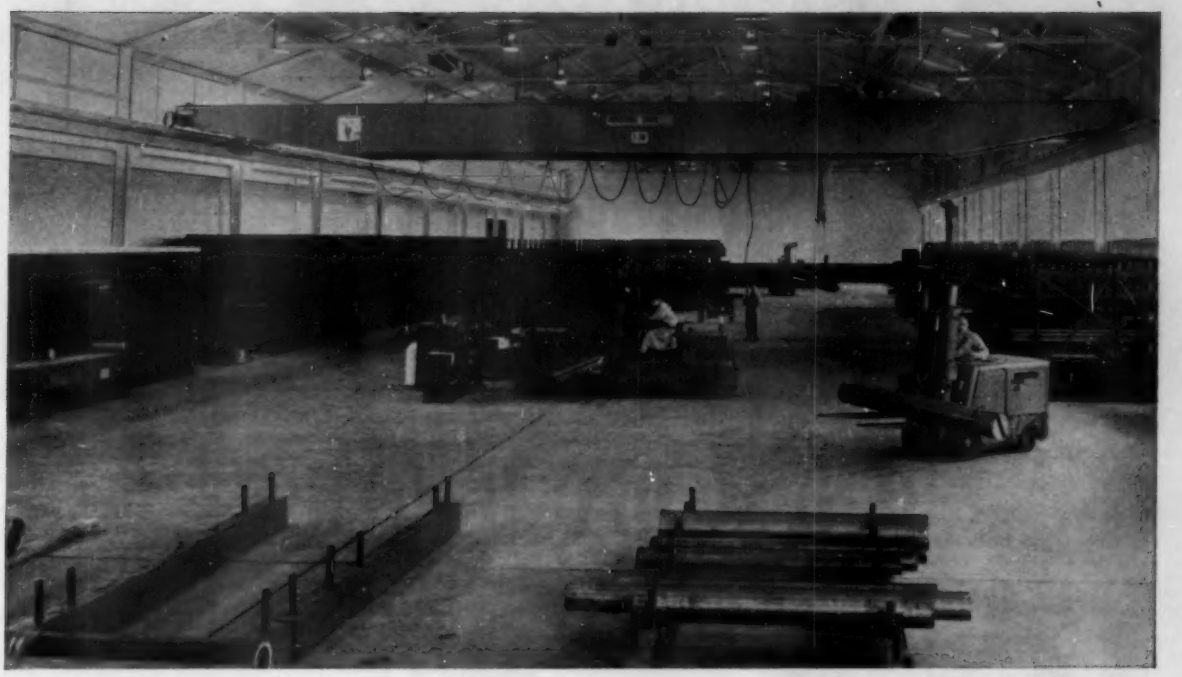
Continuous service...pump delivers 52 gpm at 3000 psi. Routine maintenance annually...plungers are repacked as necessary. Customer reports: "complete satisfaction" with the performance of the Aldrich pump.

Field parts stock available in Carmi, Ill.; Calgary; Casper, Wyoming; Charleston, W. Va.; Houston; Los Angeles; Odessa and Tulsa. For further information, write the Aldrich Pump Company, 9 Gordon Street, Allentown, Pa.

the toughest pumping problems go to ALDRICH

NOW IN OPERATION !

New warehouse to make your Timken® graphitic tool steel and 52100 tubing shipments faster than ever



NOW you can get shipments with more speed than ever before because our new warehouse for Timken® graphitic tool steels and 52100 tubing has speed built in. Here's how the new warehouse helps you:

WITHIN 24 HOURS of the time we get your order, we can have the material on its way to you with the help of ultra-modern handling equipment and methods.

FEWER DELAYS EN ROUTE. We built our new warehouse on main railroad and truck routes in Canton, Ohio, for faster shipping.

ALWAYS A FULL STOCK. Moving steel to the warehouse now takes only minutes because mill and warehouse are side-by-side. This makes it easier to maintain full warehouse stocks.

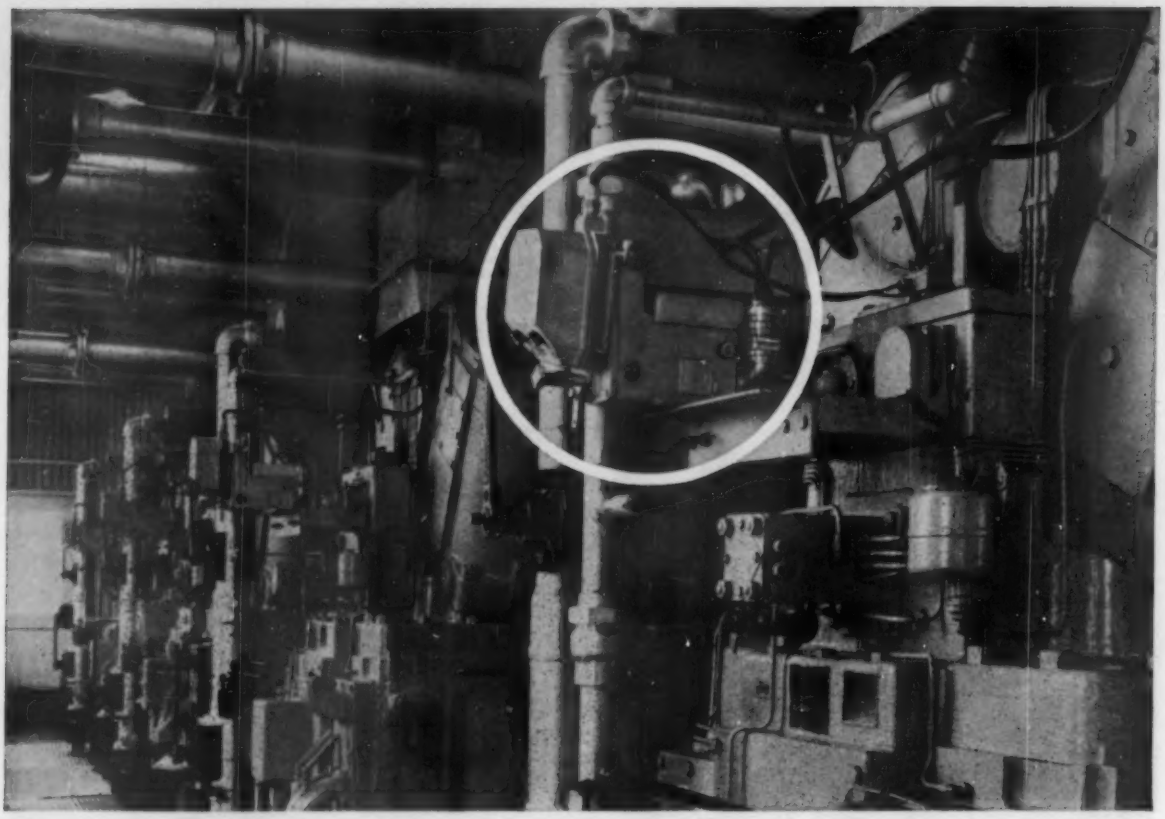
WIDE SELECTION OF STEELS. From the new warehouse, you can choose from over a hundred sizes of *52100* tubing and fifty sizes of 4620 tubing. Graph-Mo®, Graph-Air®, Graph-Tung®, and Graph-Al are available in more than one thousand sizes. You can get Graph-Mo in hot rolled bars, rounds, squares, precision ground flats, billets or hollow-bar.

Now, more than ever, when you want these steels fast, phone or write your order to The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO". Tapered Roller Bearings, Alloy Steels and Seamless Steel Tubing, Removable Rock Bits.

TIMKEN *Fine Alloy* STEEL

TRADE-MARK REG. U. S. PAT. OFF.

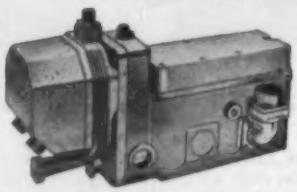
SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING



BENDIX DLC IGNITION

designed specifically for natural gas and petroleum industries

Hi-V Coil



DLC Magneto

A MATCHED IGNITION SYSTEM

1. Long service life
2. Simplified maintenance
3. Longer spark plug life
4. No unscheduled ignition shutdowns
5. Positive spark timing
6. High voltage output
7. Matched ignition system
8. Single or dual ignition
9. Flameproof
10. Low maintenance costs
11. For engines of 6 through 16 cylinders

At the installation shown here, DLC Ignition unfalteringly performs its function in aiding with the preparation of natural gas for consumer use.

Bendix* DLC Ignition is the result of the most modern engineering design, and incorporates the latest developments in ignition materials. That's why it meets the most exacting requirements of modern high-compression engines used by the natural gas and petroleum industries.

Because DLC Magneto and Hi-V Transformer Coils form a matched ignition system, it delivers ample voltage while, at the same time, assuring reduced maintenance costs.

If you want facts on why important operators specify Bendix DLC Ignition, write: SCINTILLA DIVISION, BENDIX AVIATION CORPORATION, SIDNEY, NEW YORK. *REG. U.S. PAT. OFF.

Export Sales and Service: Bendix International Division, 205 E. 42nd St., New York 17, N. Y. *Canadian Affiliate:* Aviation Electric Ltd., 200 Laurentian Blvd., Montreal 9, Quebec. *Factory Branch Offices:* Burbank, Calif.; Orlando, Florida; Chicago, Ill.; Teaneck, New Jersey; Dallas, Texas; Seattle, Washington; Washington, D. C.

Scintilla Division
SIDNEY, N. Y.

Bendix
AVIATION CORPORATION

FLOW CONTROL MASTERY

OCT

Efficiency, economy for any type completion

There is no type of completion that poses a problem when O-C-T Flow Control Units are used. In all instances involving completions with a single string of tubing, efficiency and economy are assured through use of the JS series of flow controls. The integral one-piece casting of the JS eliminates many fittings and connections.

Simplicity is inherent in the O-C-T Dual Port Flow Control. One flow control is integrally placed above another, thereby effecting savings in weight and reducing the number of pipe-to-valve and valve-to-valve assemblies. Leak-proof operation [illegible] gained.

CONVENTIONAL

NEW DUAL PORT

DUAL PORT FLOW CONTROL

JS FLOW CONTROL

where tomorrow is already here

O·C·T

OIL CENTER TOOL CO.

SUBSIDIARY OF FOOS MANUFACTURING CORPORATION

Address Export Inquiries for All Countries to P. O. Box 2091, Houston, Texas

NEW!

Humble THREDLOK
Stronger, Cheaper than tack-welding

THREDLOK 801 is a new compound that seals and locks casing joints tightly and permanently. It offers an easy, economical alternative to welding for bonding the bottom two or three joints in a casing string to prevent casing breakout during rotary drilling.

Extensive use in the field has proved that THREDLOK provides stronger joints than tack-welding. It eliminates the possibility of damage to high-strength casing that may result from welding alloy pipe. And where welding the first two or three joints in a casing string costs approximately $50 to $75, THREDLOK gets the job done for about $6.00.

THREDLOK 801 is available in pound cans, @ $3.00 per lb., at Humble wholesale plants throughout Texas and New Mexico. THREDLOK is also available through many oil field supply stores. Call the one nearest you, or phone or write:

Humble Oil & Refining Company
Consumer Sales, P. O. Box 2180
Houston 1, Texas

How to use

- Remove couplings, carefully clean and dry both male and female threads.
- Mix contents of THREDLOK can, pour converter into can and stir thoroughly.
- Apply THREDLOK to male and female threads with paddle or putty knife, making sure the threads are completely covered.
- Make the joint up immediately. It can then be run into the hole without delay.

HUMBLE

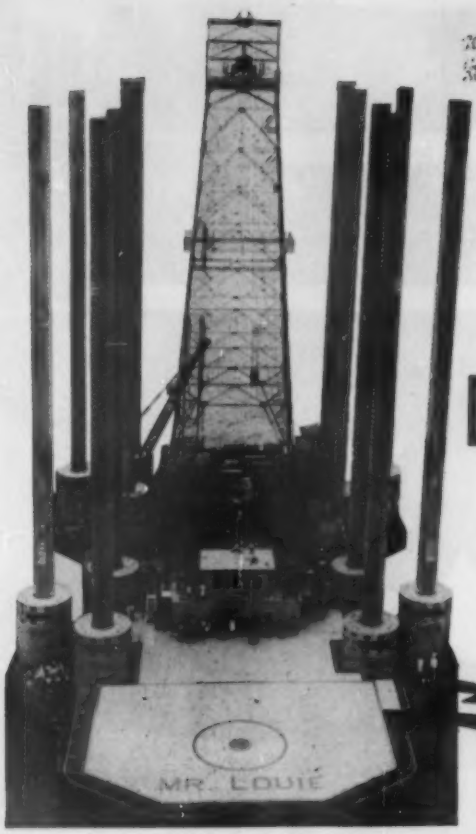
DAVISON

When gases must be DRY

Davison Hi-Sorb Silica Gel dries better

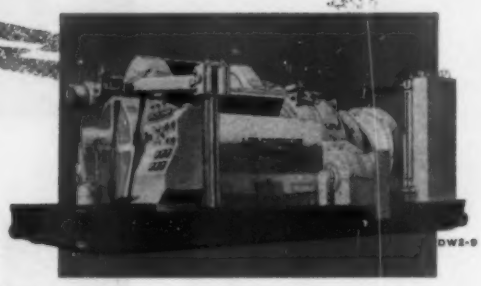
That's why Davison Silica Gel is so often to be found in natural gas dehydrators . . . in gas streams . . . in the refinery. Davison Silica Gel prevents hydrate formation which clogs lines, causes high-pressure losses and high maintenance costs. It decreases corrosion in equipment and reduces power costs in compression. Not least—it keeps customers happy! There's nothing better obtainable. Write Dept. 3116 today for full information.

W.R. GRACE & CO.
DAVISON CHEMICAL DIVISION
BALTIMORE 3, MARYLAND



Mid-Continent U-1220-EB

ELECTRA-FLOW DRAWWORKS FEATURED ON "MR. LOUIE"



Mid-Continent's "big rig" is chosen for new self-elevating drilling platform

Universal Drilling Company of New Orleans has selected a Mid-Continent U-1220-EB Electra-Flow Drawworks for their new self-elevating offshore drilling platform, *Mr. Louie*.

The U-1220 installed on *Mr. Louie* is designed for 1200 to 2000 input horsepower. This rig's reliability has been PROVEN on tests drilled below 23,000 feet. On a recent West Texas well drilled to 23,400 feet, the U-1220-EB-equipped rig easily handled 660,000-pound hook loads while setting over 15,000 feet of 9⅝" casing.

All critical hardware and brake linkage on *Mr. Louie's* U-1220-EB is cadmium plated and iridite finished, or made of stainless steel for corrosion protection. This is a standard feature on all Mid-Continent U-1220 Drawworks.

For complete information about any item of drilling machinery and other equipment, contact your Mid-Continent representative.

Mid-Continent Supply Co. furnished these major items of drilling equipment for the "Mr. Louie:"

- Mid-Continent U-1220-EB Electra-Flow Drawworks
- Two D-1000 Emsco Slush Pumps
- Mid-Continent S-27½-A Rotary Table
- 140-foot Lee C. Moore 3-well Derrick
- Regan Type M Crown and Traveling Blocks
- 500-ton Gray B-44 Swivel
- National Tube Drill Pipe
- Reed Flashweld Tool Joints

MID-CONTINENT SUPPLY CO.

MID-CONTINENT BUILDING • FORT WORTH, TEXAS

Export Division: 45 Rockefeller Plaza, New York 20, N. Y. Cable: MIDCUMPORT NYK

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

Items of Interest to the Processing Industry

WOLVERINE TUBE

PUBLISHED BY WOLVERINE TUBE

SOUTHWEST CHEMICAL COMPANY SAVES $50,000 BY USING WOLVERINE TRUFIN® TYPE S/T

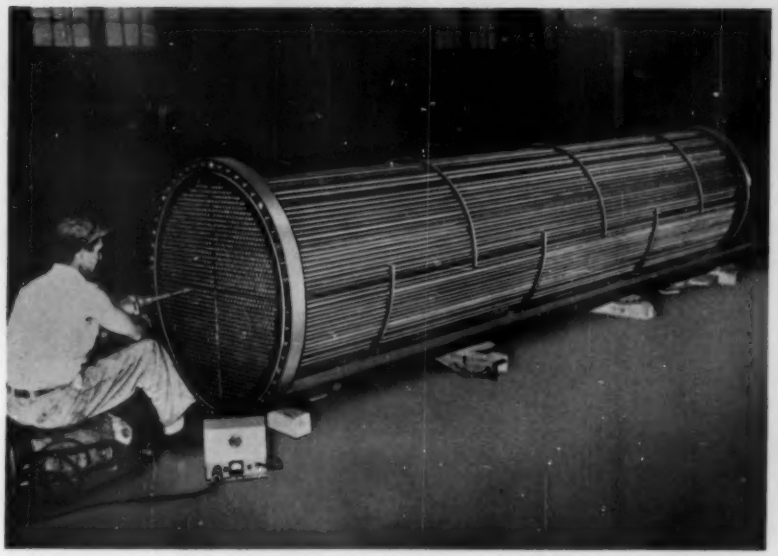
BY ERNEST DODD

Fifty thousand dollars is a lot of money . . . yet this is the amount saved by a large southwestern chemical company when it used Wolverine Trufin Type S/T condenser tubing to solve a specific heat transfer problem.

In this case, refinery engineers desired to increase the throughput of a given operation. However, a survey revealed that to get the necessary increase would require doubling the heat exchanger surface.

This would have required another heat exchanger as large as the existing unit along with additional space and structure. This naturally involved considerable money.

However, a study of the problem revealed that by redesigning the existing bundle and retubing with Wolverine Trufin Type S/T — the original, integrally-finned condenser tube — the need for the additional equipment would be eliminated. This was done using Trufin Type S/T in pure nickel form. Savings in time, labor and materials have been estimated at more than $50,000.



This is but another in the long list of authenticated examples of the outstanding heat transfer job that Wolverine Trufin Type S/T is doing throughout American industry. Why not get the complete story for yourself? Write for the Trufin Catalog or talk to one of Wolverine Tube's highly-trained heat transfer sales specialists. Their names, addresses and telephone numbers are listed on the reverse side of this page.

ADMIRALTY TRUFIN OFFERS 13% BOOST IN SURFACE AREA

Does your heat transfer operation require Admiralty condenser tube in integrally-finned form? *Then here's good news for you!*

Now — thanks to Wolverine Tube's continuous research program — it is possible to obtain a 13% increase in outside surface area of Trufin Type S/T Admiralty condenser tube.

This increase is made possible through the development of a readjusted fin contour that permits Admiralty Trufin to compare favorably in outside surface area with copper Trufin Type S/T.

As a result, shell and tube units, where Admiralty Trufin Type S/T is used, can gain a significant increase in outside surface area which in turn means a significant increase in total heat duty handled or a decrease in the size of the exchanger or both.

This is a point well worth remembering if you are about to retube existing units or are considering the design of new equipment.

TRUFIN TYPE S/T IDEAL FOR USE IN NEW OR OLD UNITS

Wolverine Trufin Type S/T is finding ever increasing acceptance in the chemical, petro-chemical and petroleum refining fields . . . for use both when retubing existing equipment or designing new units.

Retubing an existing heat exchanger can be accomplished, in many instances, simply by directly substituting Trufin Type S/T for prime surface tube. Because its integral fins give it greater outside surface area Trufin packs more heat transfer surface into a given space thus steps up the capacity of existing units.

When new equipment is being designed Trufin Type S/T permits the design of smaller, more effective units with a direct saving in materials, time and labor. Trufin Type S/T is widely used in naphtha condensing, butylene condensing and lube oil cooling—is particularly effective in handling light hydrocarbons.

Wolverine Trufin is available in Canada through the Unifin Tube Division, London, Ontario, Canada.

NEED HELP WITH HEAT EXCHANGER PROBLEMS?
LET THESE SPECIALISTS SERVE YOU

Each of these men is a highly-trained specialist in the field of heat transfer. If you have a problem concerning such things as design, corrosion, alloy selection, where and when to use integrally-finned tube, etc.—don't hesitate—give the one nearest you a call. You can depend fully on his heat transfer knowledge.

1
R. B. DAVIS
8941 Schaefer Hwy.
DETROIT 28, MICH.
WE 1-0783—1-0787

2
M. A. WALLACE
P. O. Box 569
EVANSTON, ILL.
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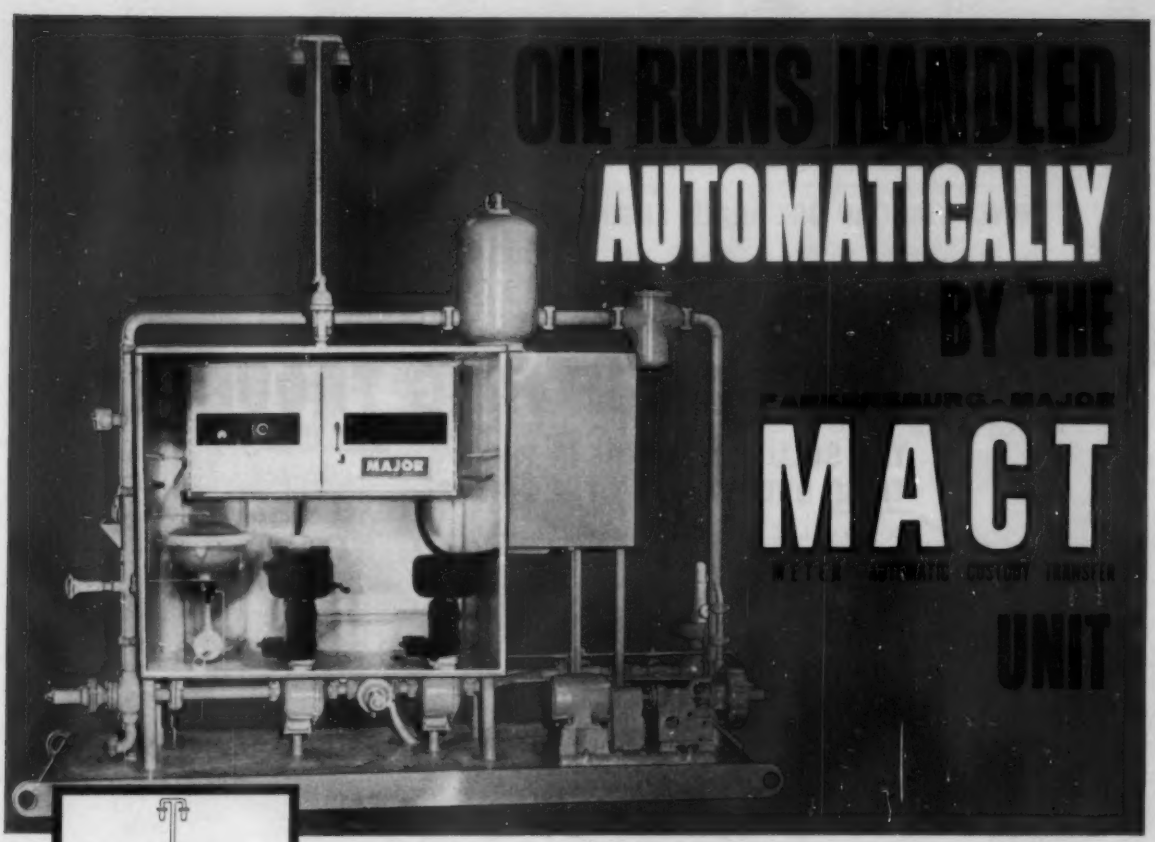

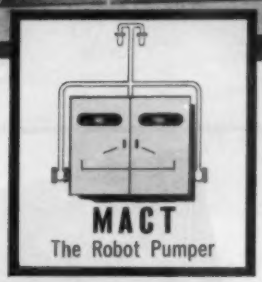

MEASURES–TESTS–SAMPLES–CONTROLS
on ONE compact, tamperproof unit

Meet MACT, the Robot Pumper. From its preset clock that starts the day's run, to the metering system that controls daily and monthly allowables, every function is automatically controlled. MACT does the job efficiently, accurately and performs all of its duties without supervision.

EXCLUSIVE FEATURES OF PARKERSBURG-MAJOR MACT UNITS:

- **COMPLETELY AUTOMATIC** The ONLY unit that indicates when the production meter requires calibrating and shuts down when meter malfunction occurs.
- **COMPLETELY PACKAGED** Installation requires only pipe, fittings, and an electric power connection.
- **PROVEN PERFORMANCE** Perfected by actual field operational experience.
- **STANDARD DESIGN** Parts readily available from Major stock.
- **INTEGRAL FOUNDATION** Prestressed, lightweight concrete base integral with skid . . . requires no field-poured foundation.
- **PLUG-IN COMPONENTS** All electrical panel components plug in . . . all relays hermetically sealed or potted. Inexperienced personnel can trouble-shoot by simply replacing tamperproof components.
- **PROTECTIVE HOUSING** Control cabinet, meter counters, and sample vessel housed for protection against weather and tampering. Windowed doors have keyed handle.
- **COMPACT** Inexpensive to ship, install and transfer.
- **ECONOMICAL** Designed and built for lowest installation cost, and negligible down time and repair cost.

For Complete Information . . . Call Your **PARKERSBURG** Representative Today!

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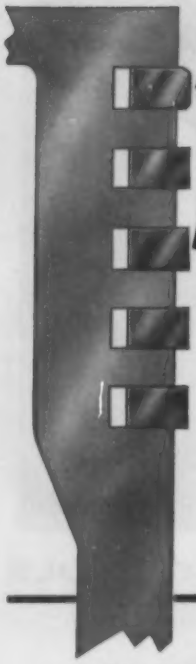
NEWS YOU CAN USE ABOUT ENGINE AND COMPRESSOR PERFORMANCE



← HAVING TOP RING TROUBLE?

THE SOLUTION MAY BE IN THE THIRD GROOVE — NOT THE FIRST!

If you've had trouble with your top piston rings (excessive groove wear, groove damage, ring breakage, etc.) you won't need to be convinced that the top ring carries from 50 to 80% of the sealing load. Installing top rings of special, expensive materials is often not the answer. They may be shock-resistant but generally lack adequate wearing qualities. One likely solution is installation of a Cooktite sealing ring in the THIRD groove to relieve the load carried by the first ring. In an engine with a compression pressure of 500 psi and a firing pressure of 1000 psi, a Cooktite ring in the third groove will reduce the pressure differential on the top ring from a trouble-causing 750 psi to an easily-handled 500 psi. Ask a C. Lee Cook representative to explain in detail.

PRESSURE DIFFERENTIAL AT FULL FIRING PRESSURE

WITH COOKTITE SEALING RING IN THIRD GROOVE

500 psi

WITHOUT COOKTITE RING IN THIRD GROOVE

750 psi

MACHINED ROUND SHAPES FROM ANY MATERIAL

MADE TO YOUR BLUEPRINTS

Any machined round shape that can be produced by turning, milling, rolling, lapping or drilling can be made to your blueprints by C. Lee Cook Company. Any size from 1″ to 60″, with finishes down to 4 micro-inches and tolerances as close as .0002″. And, there's almost no limit to the materials that can be machined. Send your blueprints for quotation or contact us for engineering recommendations. *Airtomic Products Division*, C. Lee Cook Company, Louisville 3, Ky.

WRITE FOR COOK'S NEW PISTON RING CATALOG

Sixteen-page catalog just off the press. Describes complete line of piston rings manufactured by C. Lee Cook Company, also the special rings of the Airtomics Division. For your free copy, write: C. Lee Cook Company, 934 South 8th Street, Louisville 3, Kentucky.

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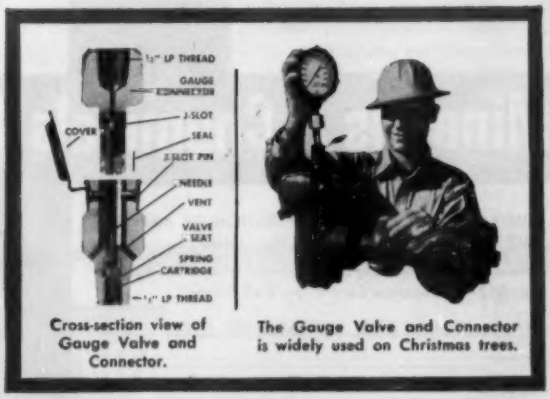
Division of Dover Corporation

Rings and Packings Since 1888

You Can Stand In One Spot And Gauge Sixteen Wells . . . With One Pressure Gauge . . . in 10 minutes!

It's no trick, and you can do it. Pictured above is a 16-well manifold at a central lease tank battery. Instead of separate pressure gauges for each well, the manifold is equipped with T-C Gauge Valves. A single pressure gauge, with a T-C Connector attached, is stabbed into each Gauge Valve to obtain a pressure reading. Just insert the connector in the valve, rotate 45 degrees, the valve opens automatically, and that's all.

For individual wells, instead of installing permanent gauges on tubing and casing, many operators are now using T-C Gauge Valves and Connectors. The first cost is lower, there's no gauge breakage—gauge repair costs are eliminated—and since the gauges are not exposed to the elements, you can be sure of accurate pressure readings.



Cross-section view of Gauge Valve and Connector.

The Gauge Valve and Connector is widely used on Christmas trees.

THORNHILL CRAVER CO.

P. O. Box 1184, Houston, Texas

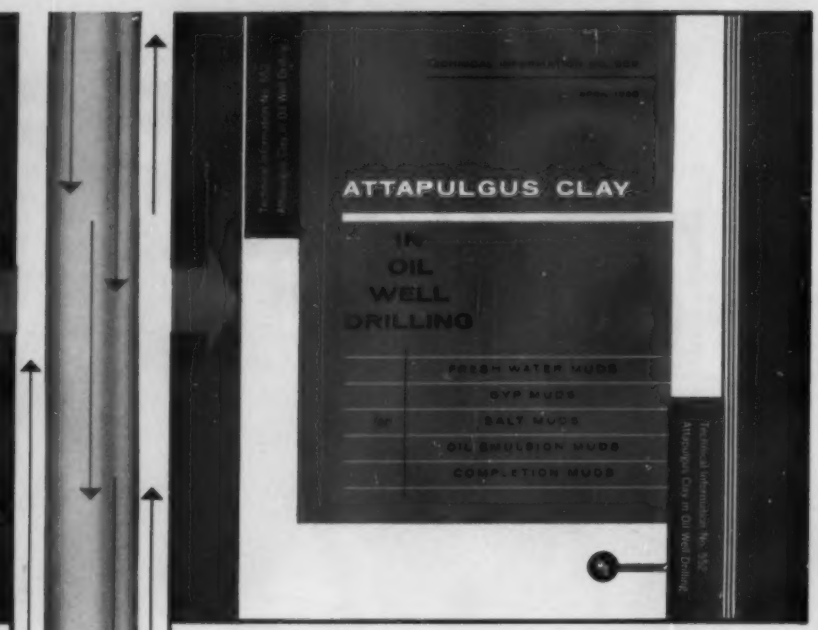
Improved

ATTAPULGUS DRILLING CLAY

INCREASES BIT PENETRATION RATES

Here is the "How" and the "Why"

NEW 12-page fully graphed brochure... just send the coupon for your personal copy.



"Attapulgus Clay in Oil Well Drilling" is a study-in-depth of the fundamental behavior of the two most widely used drilling clay materials. Presented for the first time are comparisons of the effects which common mud contaminants have on yield, viscosity and filtration properties of attapulgite and bentonite dispersions. Text includes 12 sets of curves, methods for applying *improved* Attapulgus Drilling Clay. Coupon brings your copy.

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Electrolytic test of "33" coated WECO Union —During the test the union was made-up and broken-out more than 100 times with a hammer, without destroying the electrolytic protection.

CORROSION RESISTANCE!

Unretouched photos of unions subjected to an offshore water splash test for several months. Notice the protection afforded by the "33" coating.

COATED

UNCOATED

U-2-59

NOW . . . Any WECO Union Available Fully Insulated

WECO UNIONS in any size or pressure rating are now available, fully insulated, at a very nominal additional cost. Our amazing new "33" coating, applied by special process, internally and externally, to both subs and wing nut provides high resistance to electrolytic action. Completely coated, there is no conductive metal-to-metal contact between any parts of the union.

"33" coating is tough and flexible . . . fully tested in the laboratory and field. WECO Unions with "33" coating have been made-up and broken-out hundreds of times without destroying electrolytic protection through the union.

In addition to its electrolytic resistance, "33" coating protects against the corrosive action of line fluids, external vapors and atmospheric conditions in a multitude of services. WECO UNIONS with "33" coating are ideal for offshore installations, refineries, fuel storage systems and many other applications requiring internal as well as external corrosion protection.

See your WECO representative or visit your supply store for WECO Unions with "33" coating to protect against electrolytic action and corrosion. To specify WECO UNIONS with the "33" coating, simply add "33" to the figure number of the WECO Unions you want.

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WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

Division of CHIKSAN COMPANY a subsidiary of FOOD MACHINERY AND CHEMICAL CORPORATION

fmc

Marsh Mastergauge

...the gauge that has everything!

LEAK-PROOF ONE-PIECE CONSTRUCTION from socket to tip of bourdon tube...accomplished by the exclusive Marsh "Conoweld" process.

STURDY "MARSHALLOY" CASE formed of boiler-plate thickness steel, copper clad inside and outside by "Marshalloy" process to give it all the durability and the corrosion resistance of solid copper with the dependable strength of steel.

SUPERLATIVE "MASTERGAUGE" MOVEMENT with exclusive "coined" sector gear, self lubricating, frictionless action and other refinements that add years to service life.

TYPES FOR EVERY SERVICE...wide range of bourdon tubes including stainless steels and monel. Full range of pressures, vacuum, compound gauges in endless sizes, case styles. Only Marsh has the "Safecase" for dangerous gauge applications.

"Mastergauge" is standard bearer for the broad line of Marsh Gauges fully covered in Catalog 76-G. All are available with the "Recalibrator" —best way to correct a gauge that has been knocked out of adjustment.

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"THE STANDARD OF ACCURACY"

GAUGES • DIAL THERMOMETERS • REFRIGERATION INSTRUMENTS • HEATING SPECIALTIES

FOR PUMPING OILS, CHEMICALS, SOLVENTS, ETC.

TURBINE PUMPS THAT "RATE" by DEMING

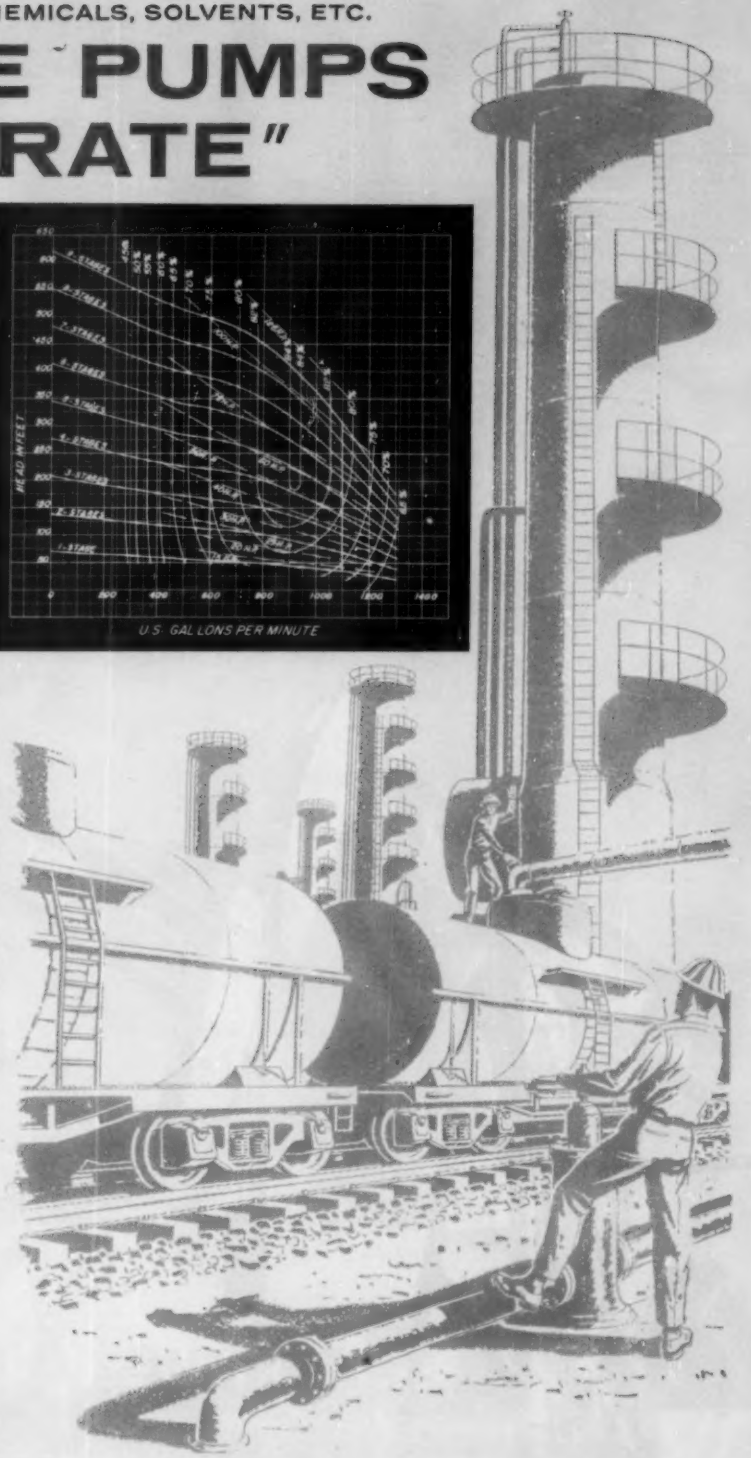
Deming close-coupled Turbine Pumps are engineered and recommended for specific industrial applications at the highest performance ratings. The functional reliability of Deming close-coupled Turbine pumps is basic. It comes from years of "know-how" in design and manufacture. The "performance rating" chart illustrated is but one of many indicating Deming top performance under critical operating conditions.

Specify a Deming close-coupled Turbine Pump with confidence. They are available in a broad range of sizes and drives.

Figure 4700: Available with bowl sizes from 4 to 16 inches in a complete range of sizes with any type power.

Figure 4703: Designed especially for pumping gasoline and oil from underground tanks. Capacities from 15 to 75 G.P.M. for pressures up to 100 lbs.

Figure 4700-G: For fueling systems and testing station service these pumps are usually mounted directly on steel or lined concrete storage tanks below ground. Complete range of sizes.

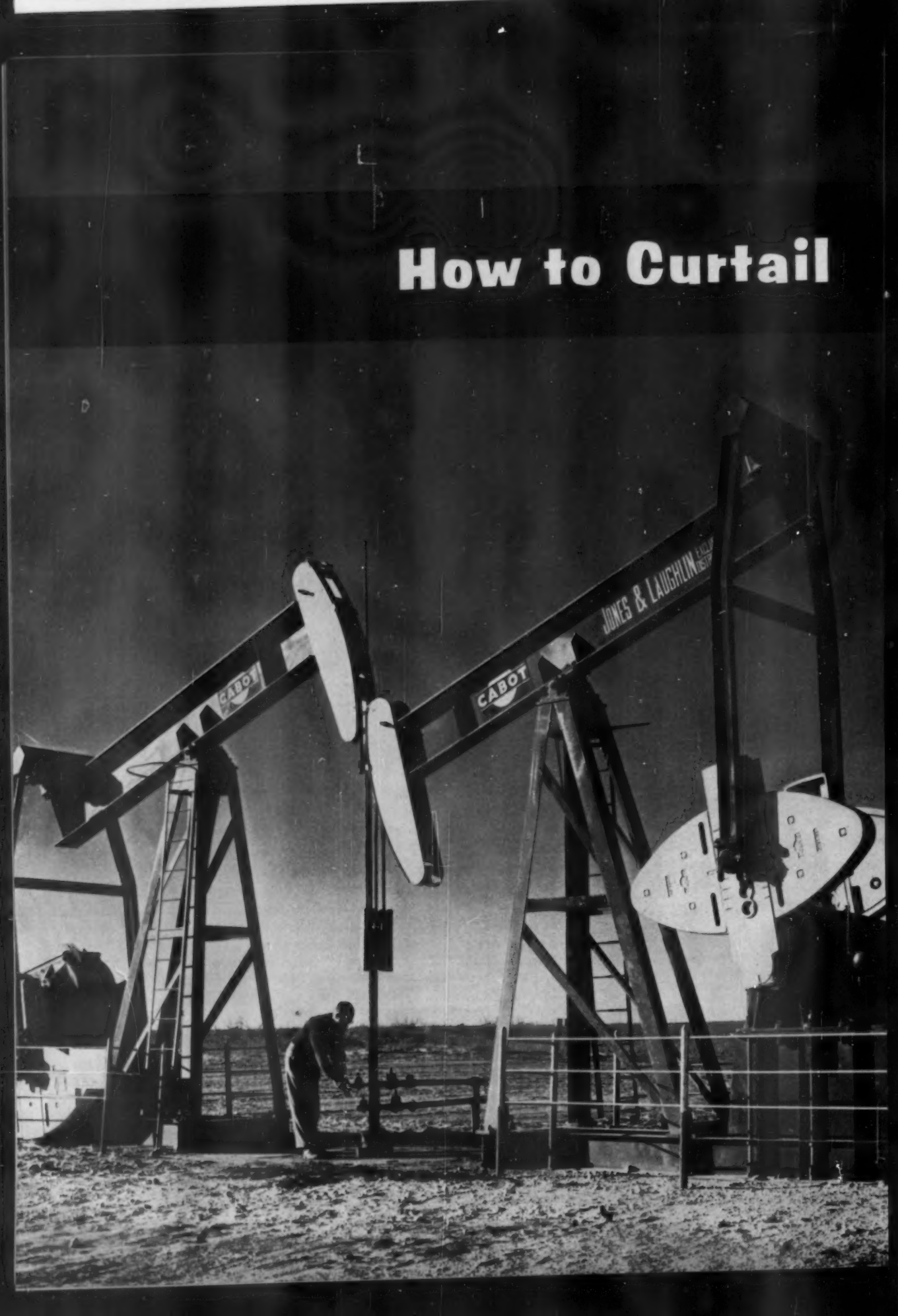


Ask for a recommendation on your next project

The DEMING Co.

603 BROADWAY • SALEM, OHIO

How to Curtail



Production Expense

Cabot adjustable-crank units are made to handle polish rod loads from 7,000 to 32,000 pounds. Replacement parts and factory-trained service men are available 24 hours a day.

An example of **Cabot** pioneering is the patented tail bearing, eliminating 62 conventional parts. It requires no attention or lubrication, and dampens shocks from sucker rods. **This bearing is covered by an 8-year service policy.**

Cabot cranks are easily adjusted by one man, standing on the ground.

Cabot reducers have Sykes-cut herringbone gears in a one-piece housing. Reducer shafts require no oil seals. **Cabot reducers are covered by a 5-year service policy.**

The **Cabot** line also includes beam-balanced units for polish rod loads from 3,000 to 11,000 pounds.

The prime purpose of a **Cabot unit** is to help you minimize production costs. If you are seriously interested in curtailing production expense, you should consider **Cabot units** — NOW! Call your J&L Supply number or write us at Tulsa, P. O. Drawer 2481.

Jones & Laughlin

SUPPLY DIVISION – Tulsa

If it's sold by J&L....
It's the best available

NEW TAYLOR ELECTRO-PNEUMATIC VALVE POSITIONER

Couples advanced electronic control with smooth pneumatic action

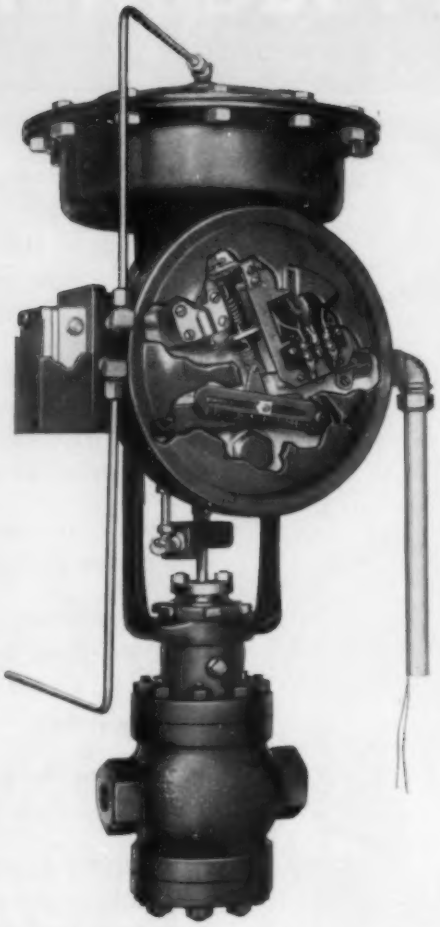
A skillful combination of new and proven design features, the Taylor 713R Valve Positioner converts an electrical milliampere input from the controller into a pneumatic force *insuring positive positioning of the valve actuator proportional to the electrical input.* It permits full utilization of the desirable characteristics of electronic control, coupled with the power and smooth throttling action of pneumatic valve actuators.

The 713R has unmatched stability, due to a powerful, balanced armature that reduces the effects of shock and vibration to a minimum. It is designed for use in hazardous areas designated for Class I, Group D, Division I equipment.

CHECK THESE FEATURES

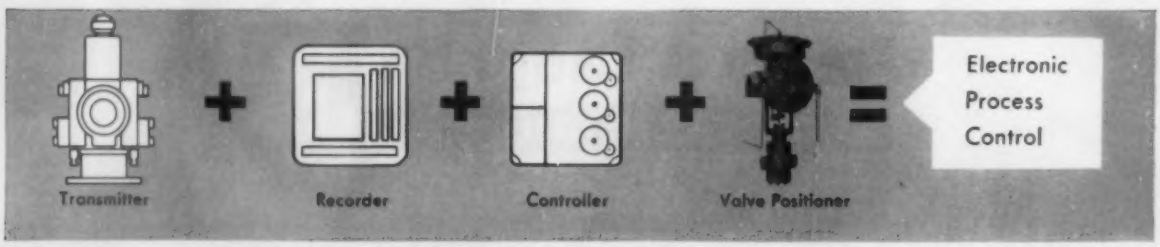
1. **High threshold sensitivity**—made possible by compact, powerful torque motor which positions stainless baffle with respect to stainless nozzle.
2. **Faster operating**—due to high capacity leakless booster relay.
3. **Wide supply pressure range**—operates with air supply pressure between 20 and 50 psi.
4. **Economy of installation and operation**—designed for use on regular plant air.
5. **Easy, safe servicing**—externally-mounted booster relay can be removed without breaking the electrical circuit, and without affecting its protection in hazardous areas.
6. **Standard input ranges**—1 to 5 ma, 4 to 20 ma, and 10 to 50 ma dc signal.
7. **Great adaptability**—same basic positioner can be applied to *reverse* or *direct* actuators, *reverse* or *direct* valve bodies, and other makes of actuators.

See your Taylor Field Engineer, or write for **Bulletin No. 98334.** Taylor Instrument Companies, Rochester, N. Y., or Toronto, Ontario.



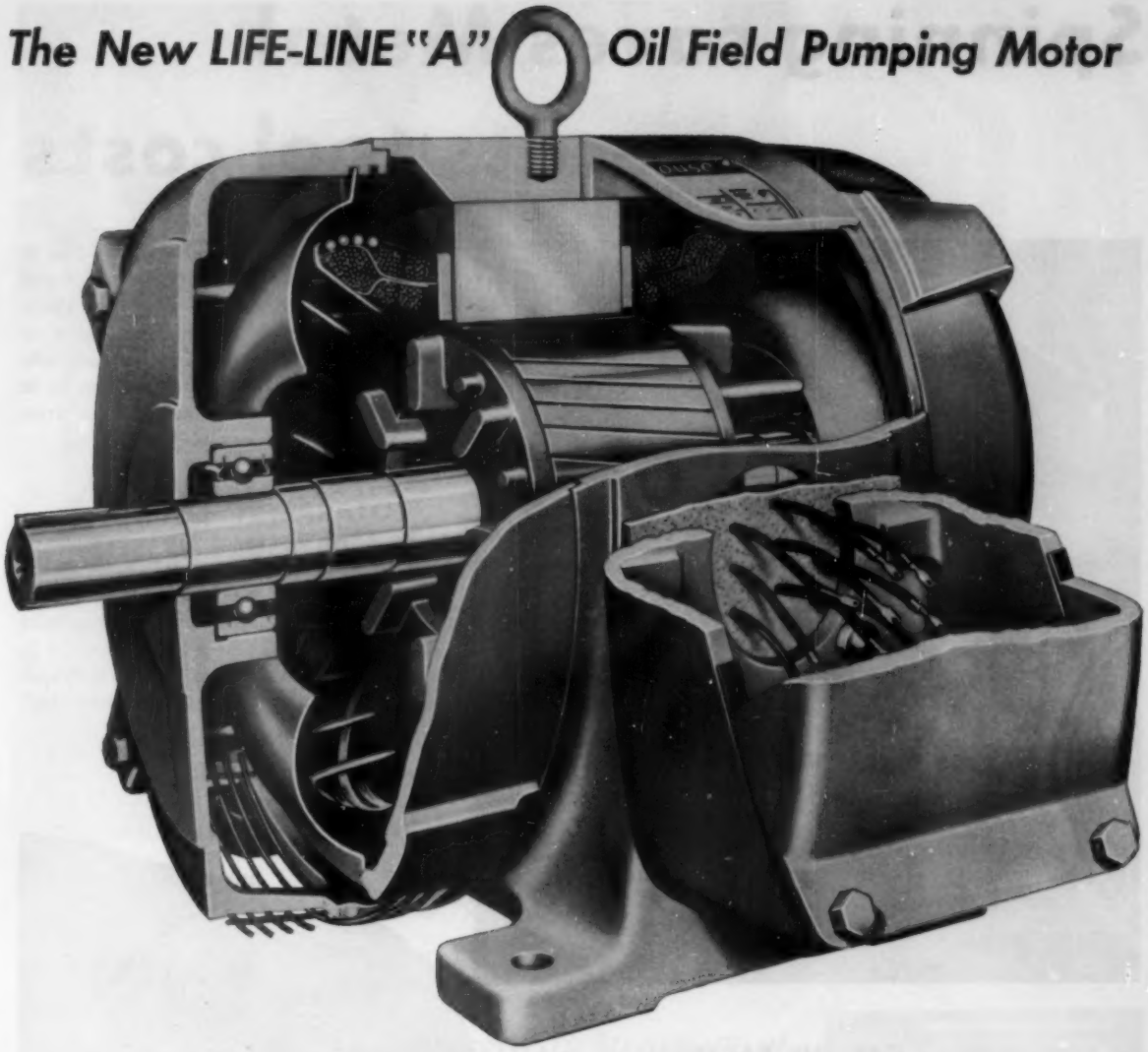
Taylor Electro-pneumatic Valve Positioner mounted on new Taylor LIN-E-AIRE Valve Actuator.*

*Trade-Mark



Taylor Instruments **MEAN ACCURACY FIRST**

The New LIFE-LINE "A" Oil Field Pumping Motor



BALANCED DESIGN
for dependable, long service

- Extra capacity for unusual load demand
- Peak performance for wide range of voltages
- High starting torque for positive breakaway

The balanced design of the new Westinghouse oil field pumping motor assures you of reliable performance under any conditions. Built especially for oil field pumping service, this new Westinghouse motor's extra capacity will meet *any* unusual load demands. Its 40° C rise gives you long insulation life and the extra temperature margin needed to handle the short-time overloads often present in this type of operation. Low magnetizing current assures high power factor for the entire voltage range. Starting torque, too, at 10 percent below rated voltage is higher than NEMA C requirements and is great enough to assure breakaway even under icing conditions.

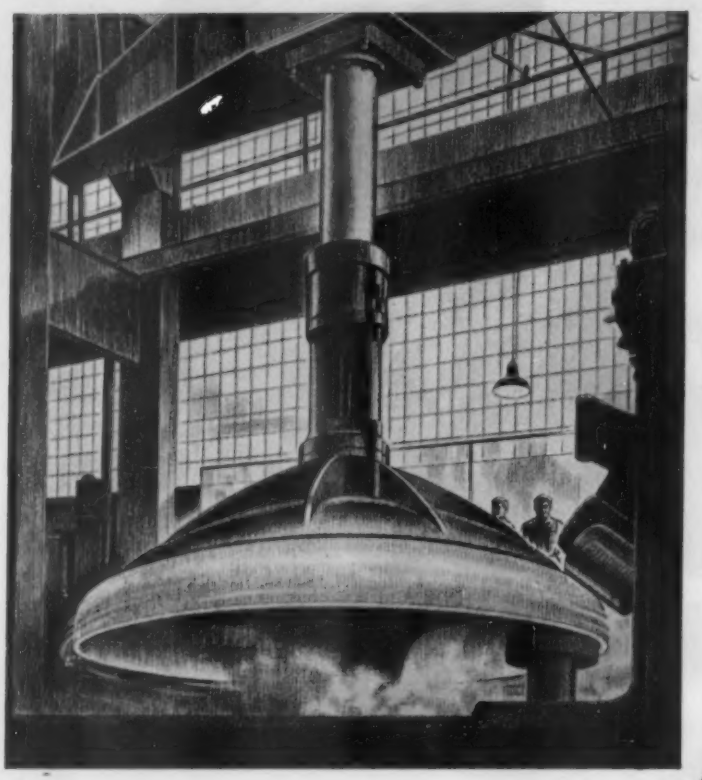
In addition to performance, this new motor is mechanically protected with antirodent screens, special baffling to protect against splashing liquids, gasketed cast-iron conduit boxes, and eyebolts in all frame sizes.

For complete information call your nearest Westinghouse sales office, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-22105

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

Spinning saves Metal —cuts tool costs



Dished and flanged ends Rotarpress spun by Harveys greatly facilitate the design and production of Pressure Vessels of all kinds. These ends combine semi-ellipsoidal form with large knuckle radius, allowing a substantial reduction in plate thickness to be effected, and in most cases the preparation and cost of expensive tools is eliminated.

'ROTARPREST' ENDS FOR PRESSURE VESSELS

can be supplied in Mild, Alloy and Clad Steels and non-ferrous metals. The capacity of the Rotarpress ranges from 5 ft. to 15 ft. diameter and from ⅜ in. to 4 in. thickness; knuckle radii may be varied to meet individual requirements.

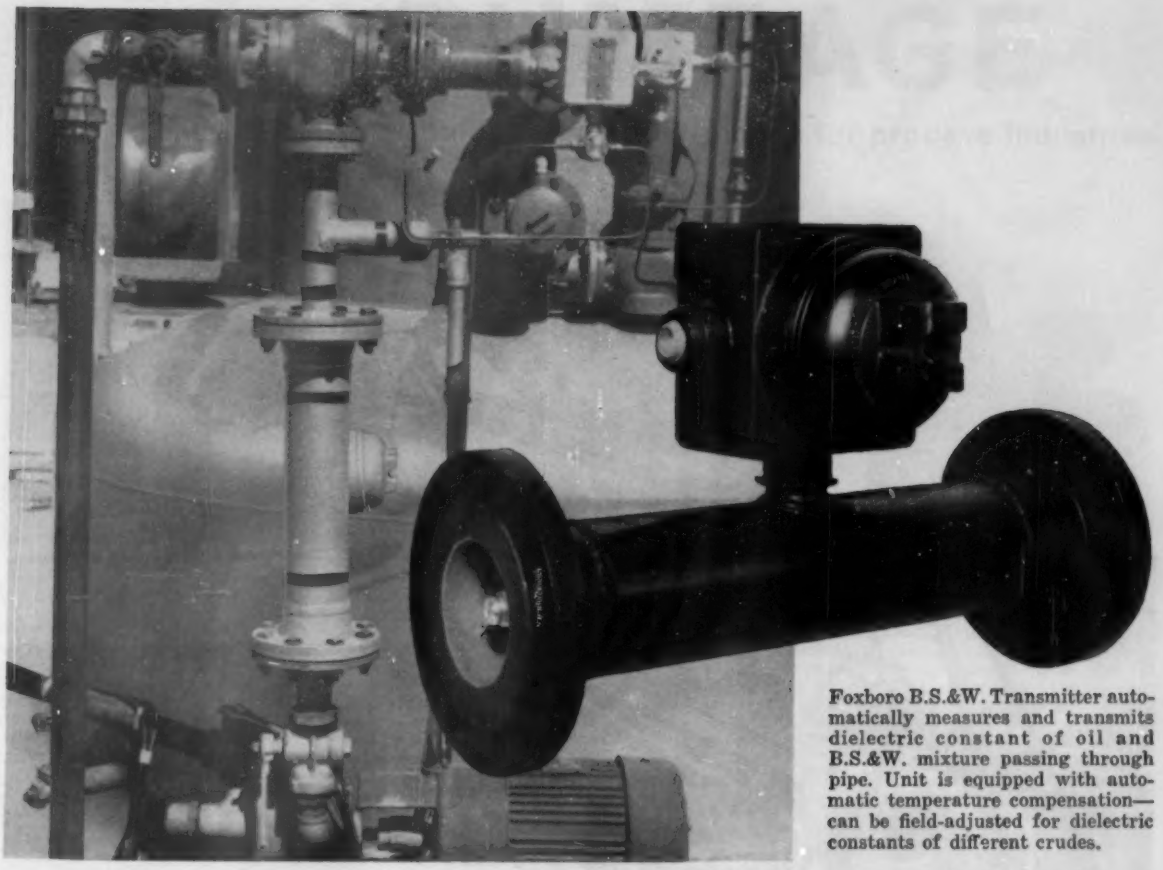
GET THE FACTS!

Our latest catalog gives details of the diameters and profiles to which 'Rotarprest' Ends can be produced, along with a table of tolerances and notes on the calculation of plate sizes for alternative flange depths. Send for Catalog No. OG 965.

Harvey

G. A. HARVEY & CO. (LONDON) LTD.
WOOLWICH ROAD, LONDON, S.E.7. ENGLAND
Cables: 'Cheaper, London.'

SPECIALISTS IN THE PRODUCTION OF DISHED AND FLANGED ENDS FOR THE PETROLEUM INDUSTRY.



Foxboro B.S.&W. Transmitter automatically measures and transmits dielectric constant of oil and B.S.&W. mixture passing through pipe. Unit is equipped with automatic temperature compensation—can be field-adjusted for dielectric constants of different crudes.

unique Foxboro system gives continuous, unattended measurement of B. S. & W.

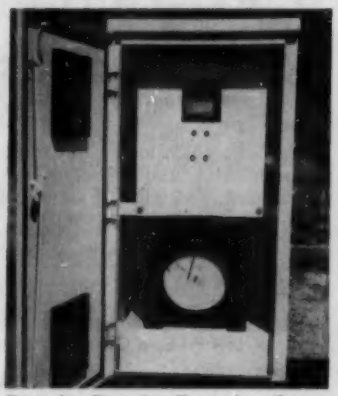
— *plus records to prove it.*

The instant the B.S.&W. content of crude oil exceeds preset percentage you know it, with this unique Foxboro monitoring system.

Here's how. A Foxboro measuring element, installed in the pipeline, continuously measures B.S.&W. content of the crude, in terms of dielectric constant. Changes in dielectric are then transmitted electrically to a Foxboro capacity Dynalog* Recorder.

And that's it. Remedial action can be incorporated by having the Dynalog Recorder equipped with an electric contact for sounding an alarm or operating diversion valves to re-route off-spec oil.

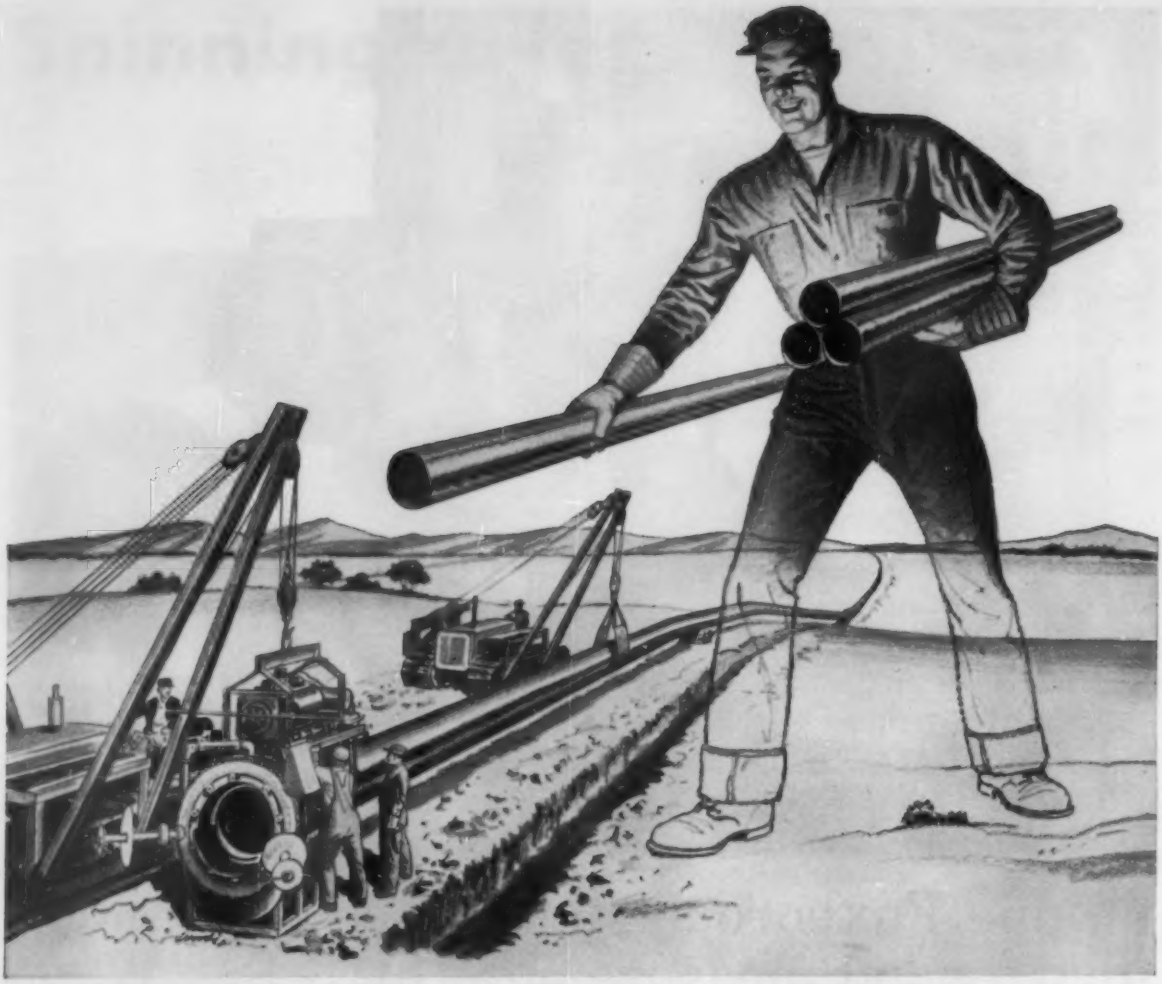
Not only does the Foxboro B.S.&W. System fully meet the specifications of A.P.I. Bulletin 2509A, but also it is the most accurate, automatic, and trouble-free method of policing B.S.&W. available. Ask your nearby Foxboro sales engineer for details. He can tell you about dozens of these systems now at work throughout the world. **The Foxboro Company, 606 Neponset Ave., Foxboro, Mass.**



Capacity Dynalog Recorder (lower instrument) receives measurement from B.S.&W. Transmitter, records it, and initiates alarms or re-routing of oil flow.

FOXBORO instrumentation

REG. U.S. PAT. OFF.



CF&I-Claymont Large Diameter API Pipe

This giant steelman represents CF&I ... in its capacity as an experienced, primary producer of quality steels and steel products, including large diameter welded steel pipe.

CF&I's Claymont plant melts its own steel, rolls its own plate, and produces top-quality large diameter welded steel pipe of all kinds—to API and various other specifications.

CF&I-Claymont Large Diameter Pipe is supplied for many standard and special uses, including:

- Natural Gas or Crude Oil Transmission Lines (High Pressure)
- Low Pressure Gas Lines (within urban limits)
- Casing or Encasement Pipe for Highway and Railway Crossings
- Compressor Station Piping
- River Crossings (Heavy Type)
- Gas and Oil Storage Lines

Standard sizes of CF&I-Claymont Pipe, from 22″ through 36″ O. D., in 40′ lengths, and special sizes to customer specifications, can be supplied.

Check Claymont first, when you need large diameter pipe of any kind, for any use. Contact the CF&I sales office nearest you for complete details.

CF&I-CLAYMONT PRODUCTS: Carbon Steel Plates • Alloy Steel Plates • CF&I Lectro-Clad Nickel Plated Steel Plates • Clay-Loy High Strength Low Alloy Steel Plates • Flanged and Dished Heads • Manhole Fittings and Covers • Fabricated Steel Plate Products • Large Diameter API Pipe

Claymont Steel Products

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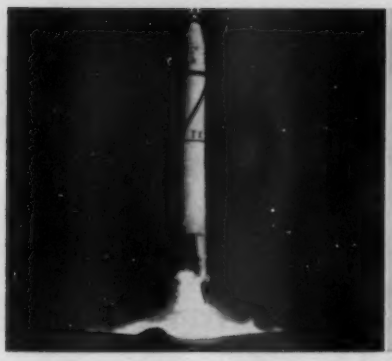
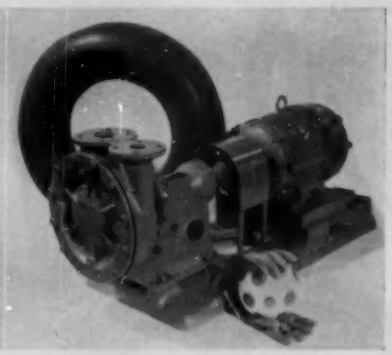
PUMPAGE

Goulds news about pumps for process industries





Rocket's red roar

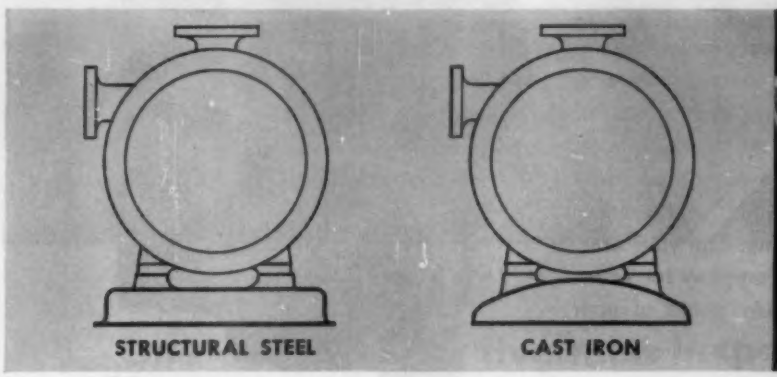
After the countdown—a roaring and soaring! The fuels that make rockets roar contain highly abrasive solids, ignite and burn rapidly with the slightest contact with air or oxygen. Handling them is a problem—pumping temperatures run as high as 550° F. For one government installation, Goulds developed a vertical process pump with an inert gas chamber that is used as a barrier between pumpage and rotating shaft seal. Gas pressure is maintained by an automatic purgerator slightly above suction inlet pressure to insure no contact between the mechanical seal and the abrasive solids. This pump has been found so broadly applicable that it is now a standard model in our line.

Now . . . a centripetal pump!

A unique use of centripetal action lets Goulds Fig. 2520 handle liquid, air, or liquid *and* air! The centrifugal force of the impeller separates the liquid from the lighter air, which accumulates at the center of the impeller and casing. The liquid, circulating at the casing periphery, is directed (by centripetal action) toward the center, pushing the air ahead of it and through the discharge. Once primed, this pump *stays* primed! It can't air bind—even with loops or leaks in your suction line. Handles foaming solutions and emulsions easily. You can use it for almost anything: as a scavenger, for transfer work, for cleaning up, for pilot plant work. Ask for Bulletin 725.6 for all the details!

Latex: Handle with Care

Before synthetic latex can become the bouncy consumer products you see here, it must be a fairly instable liquid, able to gel or coagulate easily. For that reason, a pump must handle latex gently or the impeller will clog and have to be cleaned frequently. Such a pump is the Goulds Fig. 3715—six of which are presently being used by a rubber manufacturer to transfer latex from storage tanks to tank cars and in the latex concentrator line. A semi-open impeller allows a minimum of mechanical shock or friction at optimum efficiency. Normal cleaning operations are performed easily, because the casing cover and impeller can be easily removed without disturbing pipe connections. Bulletin 725.4.



Cast-iron bedplates

A rigid well-grouted bedplate under your pump and driver is the first requirement for trouble-free operation. Accordingly, Goulds furnishes rigid corrosion-resistant cast-iron bedplates as standard at no extra cost. The Goulds special camber top prevents accumulation of corrosive liquids. The camber design with its large accessible grout hole at the high point insures complete fill-up of bedplate cavity with grout. This economical design, jig-drilled for pump and motors, provides integral motor pad, eliminating costly separate motor base.

GOULDS PUMPS

Get all the news monthly—FREE!

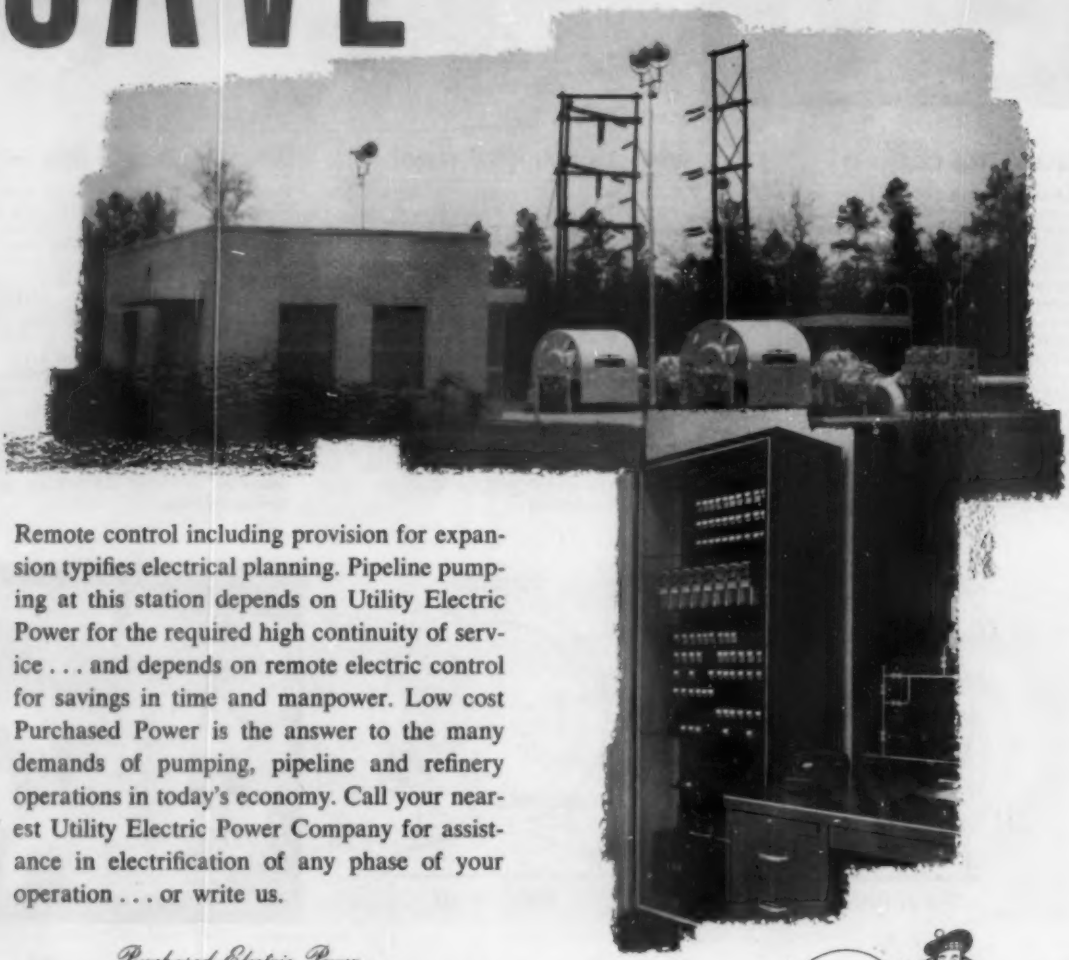
If you've liked reading about the new designs and applications of pumps as presented on PUMPAGE, then you'll appreciate getting a sister publication, GOULDS NEWS, mailed to you free every other month. GOULDS NEWS is a 4-page newsletter that highlights new developments in pumps and profitable ways that they are used. You can add your name to our mailing list by merely writing, on your letterhead, to Goulds Pumps, Inc., Dept. OG-69 Seneca Falls, N. Y.

SAVE manpower

SAVE money

SAVE maintenance

SAVE with Electrified Pipelines



Remote control including provision for expansion typifies electrical planning. Pipeline pumping at this station depends on Utility Electric Power for the required high continuity of service . . . and depends on remote electric control for savings in time and manpower. Low cost Purchased Power is the answer to the many demands of pumping, pipeline and refinery operations in today's economy. Call your nearest Utility Electric Power Company for assistance in electrification of any phase of your operation . . . or write us.

Purchased Electric Power . . .
saves money, manpower, maintenance
and serves you better automatically

PEPA

Petroleum Electric Power Association

P.O. BOX 35006, DALLAS 35, TEXAS

A National inspector performs a careful thread gauge check on Spang Extreme Line Casing.

One out of every five men inspects for you!

THE NATIONAL NSCO SUPPLY COMPANY

In the plant where we manufacture Spang Tubular Products, 20% of the employees are inspectors. They never compromise on Spang quality. Frequent and thorough inspection is another reason why Spang specialists set the standards by which all other oilfield tubular products are judged.

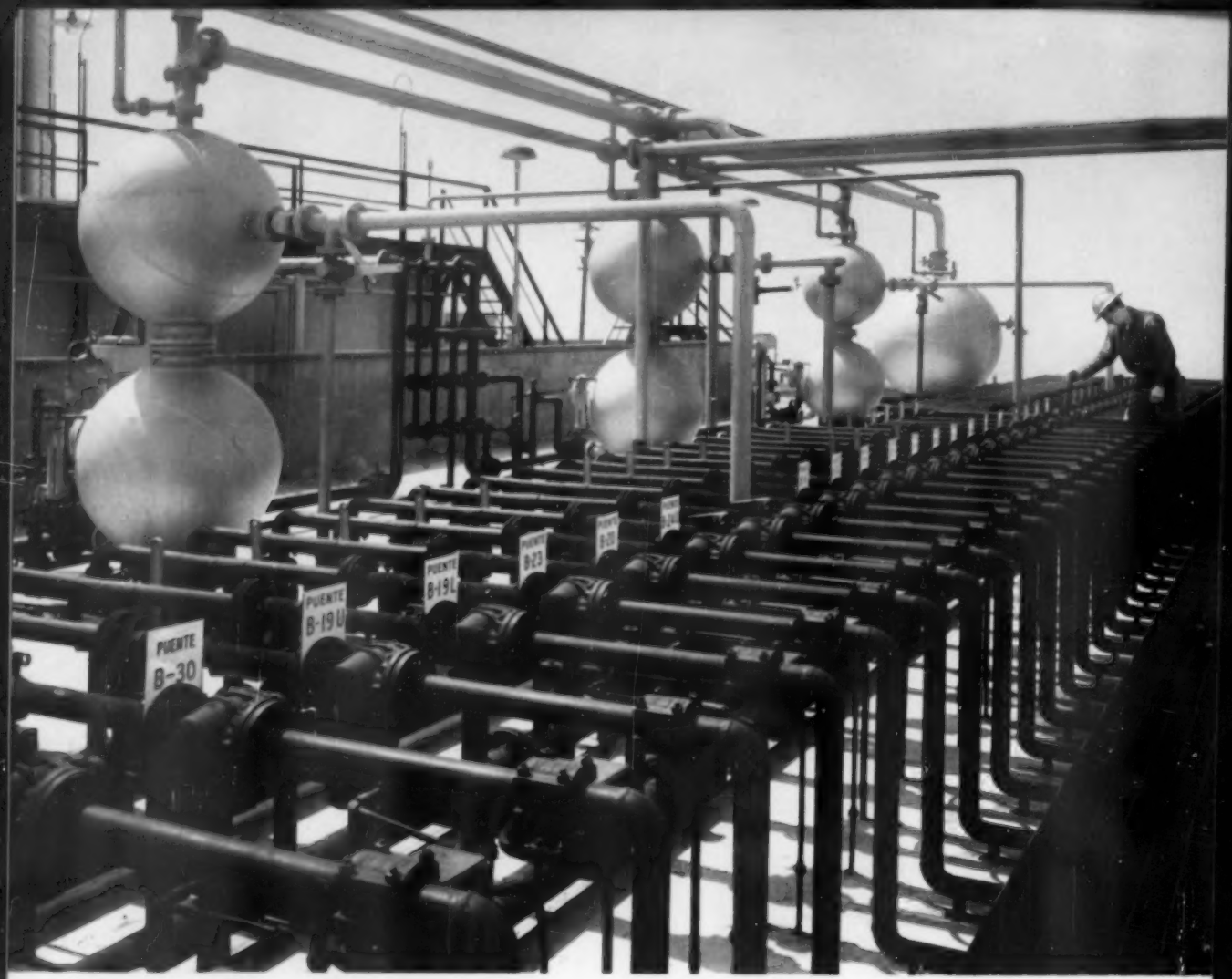
More on the next page

Why Spang Extreme Line Casing is specified for the world's deepest, high pressure wells

- 100% leak resistant
- Minimum major O.D.
- Minimum number of threaded connections
- Positive shoulder contact engagement which prevents overtonging
- Streamlined exterior and interior contours
- Easy to handle and stab
- Cannot be cross-threaded
- Available in grades for every well condition from National Supply—one source for superior oilfield tubular products!

Spang Extreme Line Casing has the mechanical and metallurgical properties to withstand high tensile loading, and to resist the severe pressures encountered in deep drilling.

More on the next page



Dependable Spang CW Steel Pipe is excellent for metering plant and tank farm lines. In addition to gas, oil and water lines, you can use it for roof rails, step rails and many other structural purposes.

Piping installations are easier with quality Spang CW Steel Pipe!

Spang CW is quality-controlled from skelp to finished product, and this control pays dividends on a wide variety of piping installations.

You save installation time and labor because Spang CW is easy to cut, bend, thread and weld. *Every* length is hydrostatically tested to insure uniform quality and long service life. The result is a stronger pipe with clean, tight welds and smoother finishes—inside and outside.

The best dividend is that you pay no more for this special quality pipe. All sizes of Spang CW—plain end, or threaded and coupled—are readily available through the nearest National Supply Store. Order now for your next job!

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

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DIVISION OFFICES: Calgary, Dallas, Denver, Houston, Toledo, Torrance, Tulsa

EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E.C.1

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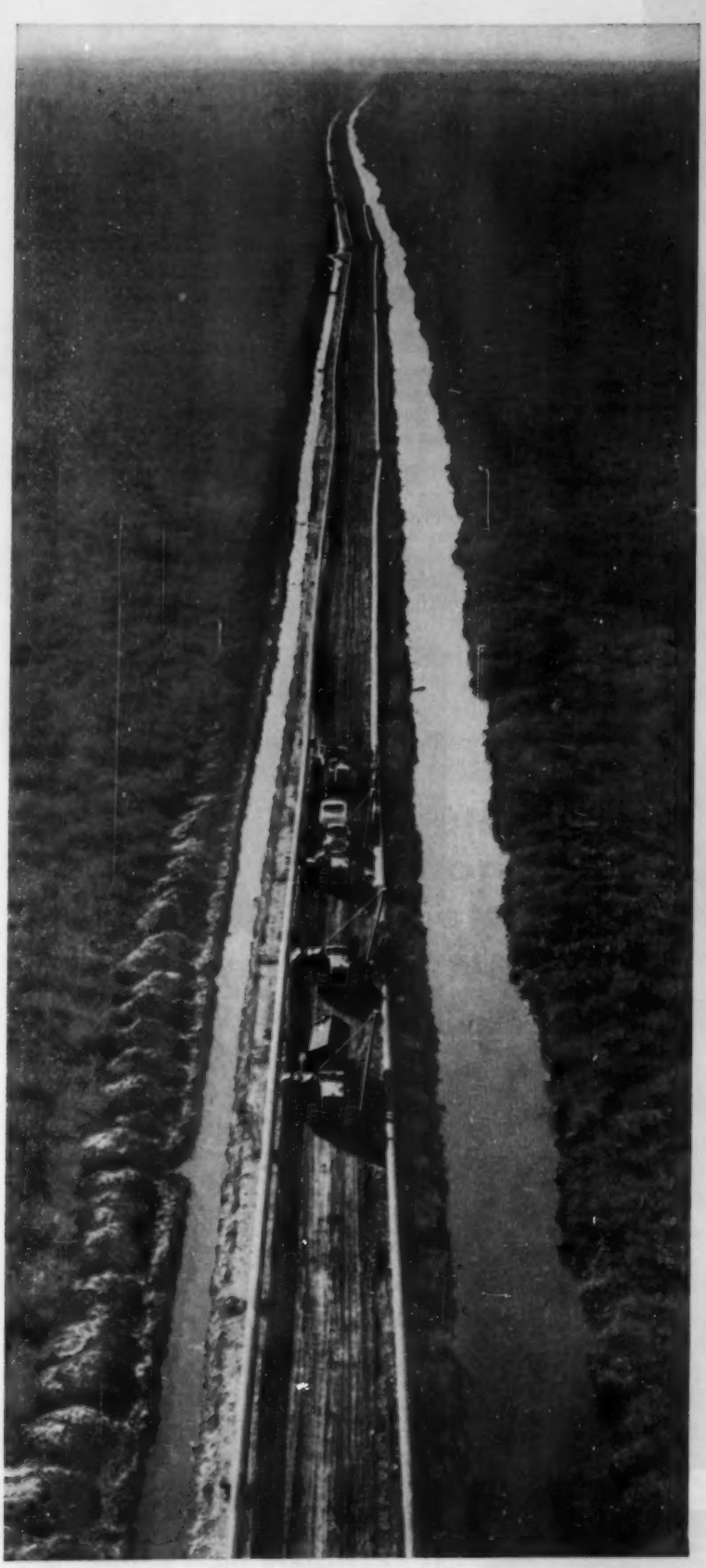


HOW TO CHECK OUT THE TOUGHEST TAPE EVER WRAPPED AROUND PIPELINE

Give it the works . . . that's what Polyken did to its latest development—Extra Strength No. 960

. . . Run it through every tape durability test a laboratory can apply.

. . . Wrap this rugged tape around 30 miles of 24-inch gas line in the swamp water and coral rock of southern Florida. Let an Iranian oil company use it on 200 miles of desert oil line. Put it to work for the Phillips Petroleum Co. in Texas and Canada.

If a tape coating can stand all this and still do the whole job cheaper than hot dope, you've got something special. Something permanent in pipeline protection—Polyken Extra Strength No. 960 Pipeline Roll.

Available at no extra cost.

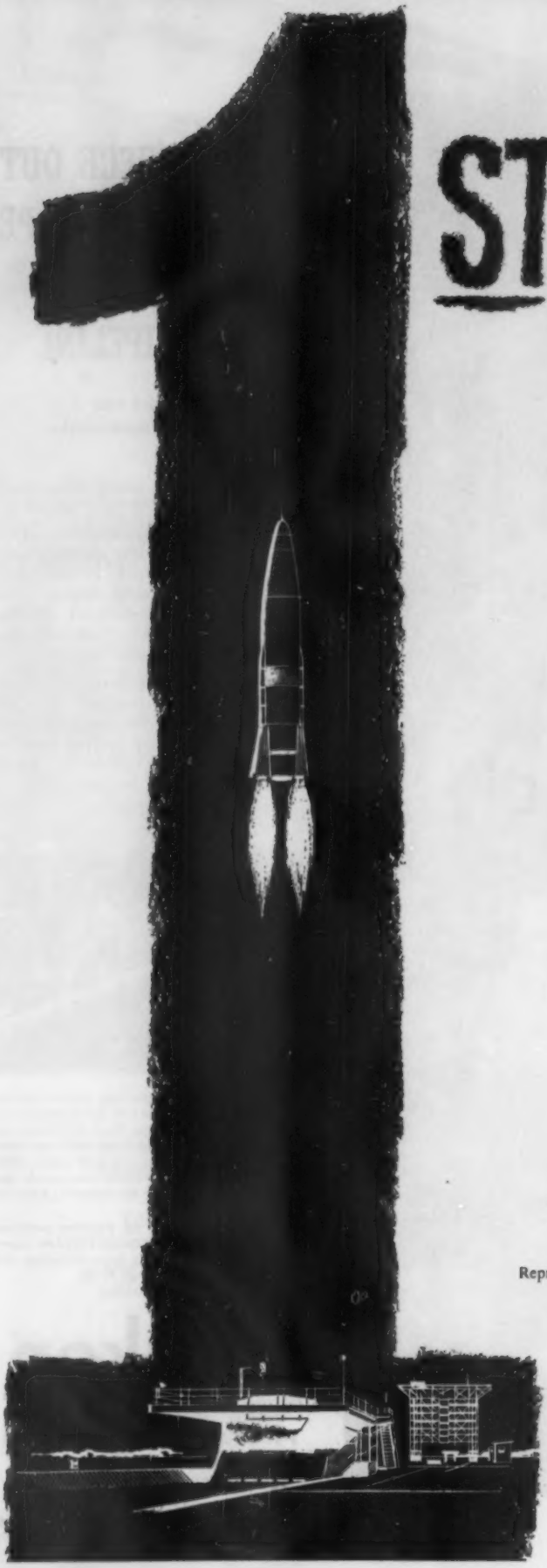
Applying Polyken protection, as seen above, the Houston Texas Gas and Oil Corporation laid a 1600-mile gas line from Louisiana to Florida. Polyken saved them $500 per mile by way of less men per job and more miles per day. Tape's ready. No primer, no drying or cooling, no fumes or fire hazard. And *low* equipment cost.

Get the full particulars on Polyken performance and economy from your Polyken representative or write Polyken Sales Division, 309 W. Jackson Blvd., Chicago 6, Ill.

Polyken®

Experienced in modern PROTECTIVE COATINGS

THE KENDALL COMPANY
Polyken Sales Division



1ST

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When you have a power problem . . . and want it solved quickly . . . why not draw *first* on the tried and proved experience of Stewart & Stevenson Services . . . the world's largest distributor of diesel engines.

In our Nation's rockets and missile programs . . . as well as in thousands of commercial applications for the petroleum, industrial and construction industries . . . Stewart & Stevenson experience and "know-how" is paying off in dependable day-in-and-day-out performance. Call, wire or write today.

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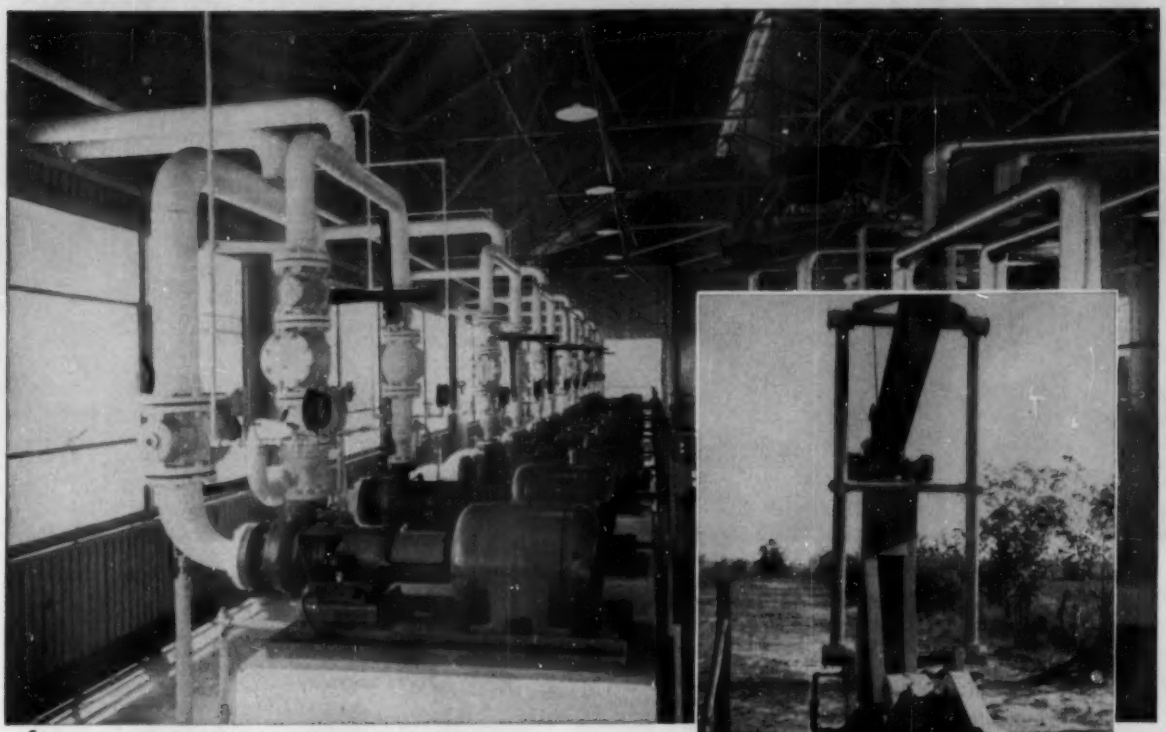
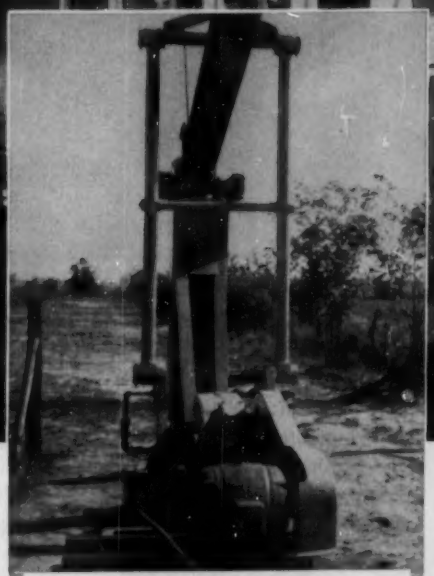
THE WORLD'S LARGEST DISTRIBUTOR OF DIESEL ENGINES

Wagner ELECTRIC MOTORS...
THE CHOICE OF LEADERS IN THE PETROLEUM INDUSTRY



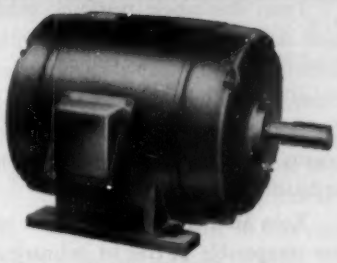


WAGNER Petroleum Industry Motors cut operating costs in *FIELD* and *REFINERY*

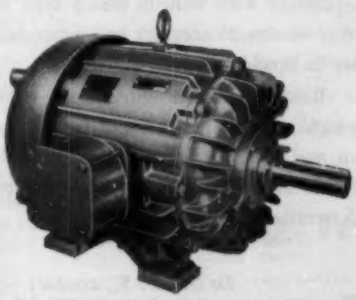
Wagner Type DP and DY Motors are especially designed to meet the load conditions of oil well pumping—to give cost-cutting, year-round, maintenance-free outdoor service. Corrosion-resistant cast iron frames and endplates protect the motor from rain, sand and snow. Conduit boxes are moisture proof and dust-tight. These motors are available for either polyphase or single phase operation. You can get them from stock in your immediate area.

You cut costs when you install Wagner Type JP explosion-proof motors in the refinery because these are built with *extra protection* that means longer motor life: the vital parts of the motor are sealed against dust, fumes, and moisture—the cause of most motor maintenance problems. These motors are approved for Class 1, Group D hazardous locations.

For full information, write for Bulletins MU-224 and MU-137, or phone your nearby Wagner branch office.



Type DP or DY oil well pumping motor. Single phase or polyphase.



Type JP standard totally-enclosed, in ratings through 250 hp; and Type ZP tube ventilated, in ratings through 500 hp.

WM59-1

Wagner Electric Corporation
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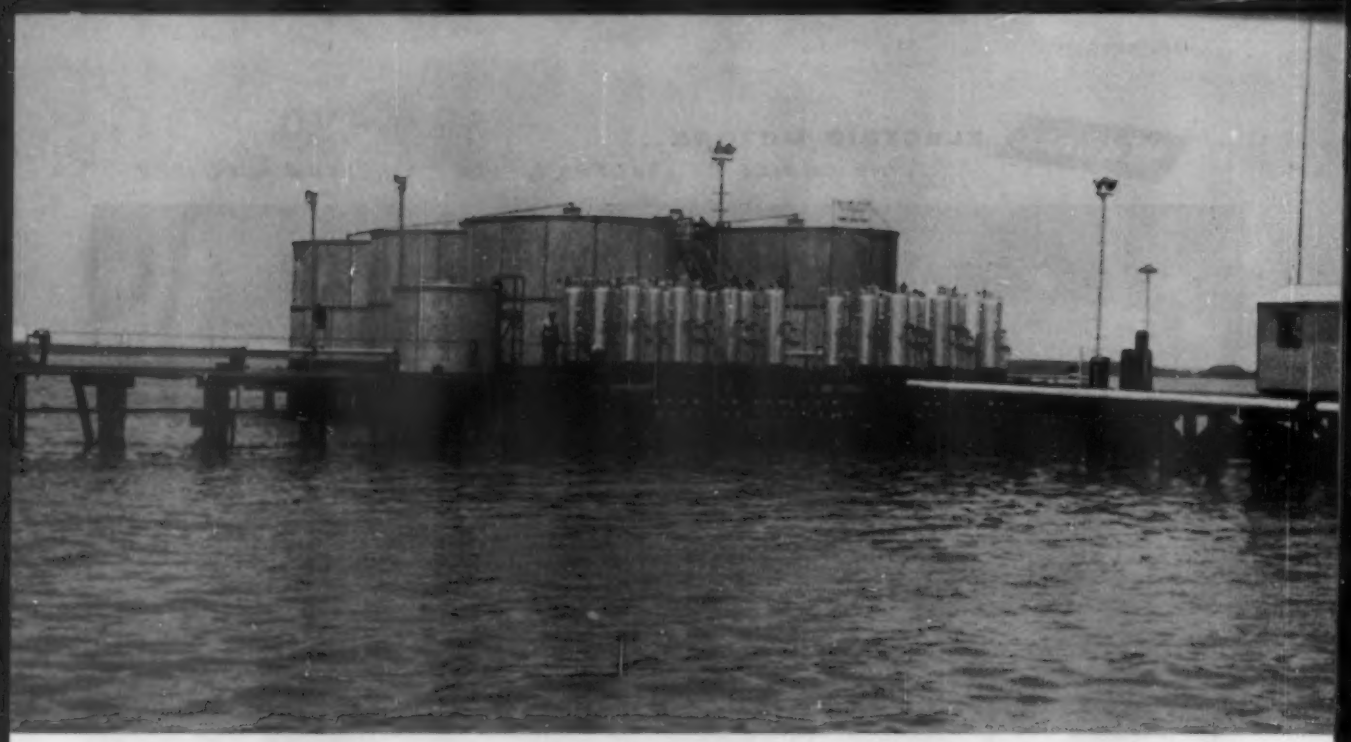
ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC



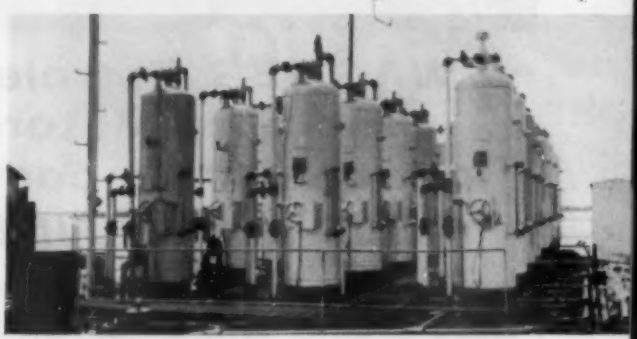
Individual well metering pays off in greater efficiency for this South Louisiana Operator

This battery of 24 Rolo Metering Separators in the South Pass Block 24 Field, Plaquemines Parish, Louisiana, gives continuous data on each well in the block and permits commingling of production and consequent savings in tankage.

From this single platform, trouble at any single well can be pinpointed rapidly with minimum effort. Individual well production figures are available at all times, and not just during a short, periodic well test. In fact, periodic well testing is eliminated, which means savings in equipment and more efficient utilization of manpower.

Rolo Metering Separators take no more space and are comparable in cost to ordinary separators without meters. The units shown are two-phase oil and gas separators with built-in dump type oil meters. They offer maximum accuracy and dependability. Thousands are in service all over the world.

Rolo also offers three-phase metering separators which separate gas, oil and free water and meter the oil and water by separate meters—all in one vessel. (Rolo Automatic Samplers are perfect accessories to determine emulsified water cut.)



Most land installations allow the location of Rolo Metering Separators at the wells, offering savings in flowlines through commingling. Contact your representative for the free booklet, "The Comparative Advantages of Individual Well Metering Over Conventional Production Systems."

Both offshore and on land, today's need for maximum data on reservoirs and individual wells makes *continuous individual well metering* more desirable than ever. For *metering* along with *separation*, specify Rolo Metering Separators, pioneered and perfected by the leader in oil well metering.

In the U. S., contact your nearest Bethlehem representative for information and prices on Rolo products. In Canada and for export, see below.

BETHLEHEM STEEL COMPANY
SUPPLY DIVISION
General Offices: 21 E. Second St., Tulsa, Okla.

ROLO MANUFACTURING COMPANY
P. O. Box 22126, Houston 27, Texas
Canada: Petro-Automation Industries, Ltd., Edmonton and Calgary
Export: R. S. Stokvis & Sons, New York, N. Y.

They Say—

More on pipeline computers

Dear Sir:

The article on the use of electronic computers to solve Hardy Cross networks (OGJ, April 20, p. 89) is limited in the information which it supplies. All previous investigators have not limited themselves to the use of the square power to the exponent of flow, Q.

The Oil and Gas Journal article Petrodatics 16 clearly shows an exponent of 1.85 and states that such an exponent was used on the IBM 650. Earlier, an issue of Engineering News Record reports a method involving the 1.85 exponent.

Commercially, solutions to this problem have been available from the Institute of Gas Technology, the IBM Service Bureau Corp., and Datics Corp. Thus, there is no novelty in following the suggestions of Professor Cross.

Actually the exponent of 1.85 has little to recommend it over the exponent of 2. Prof. W. L. Moore (Proceedings of the American Society of Civil Engineers, March, 1959) shows more clearly the relationships which exist between the exponent in the Hazen Williams equation and the more exact friction factor charts of Moody (Transactions of American Society of Mechanical Engineers, 1944).

The paper on design and evaluation of pipeline networks presented at the Kansas City meeting of AIChE carries with it the philosophy of Professor Moore. The exponent is considered constant for one system but assumed to be different for each new system. For example, in one network of the authors' experience, an exponent of 1.93 was appropriate.

Continued investigation leads us to the conclusion that the Hazen Williams equation is actually inappropriate entirely under the conditions of the present state of the art. Given the time, one could develop a program which converges toward a solution after the method of Hardy Cross but which uses the more up-to-date friction relationships of Moody. In effect, this proposed program would adjust the Hazen-Williams exponent on each pipe during the course of the iterations.

Such a program would be written for any one of a dozen medium-size or large computers. Since the engineer would be relieved of pre-guessing the exponent the program would represent a substantial forward step in the solution of pipeline net work problems.

Robert L. McIntire
Partner, Mathematical Engineering Associates
Fort Worth

With mixed emotions

"It goes without saying that the management of this company does not welcome mandatory (imports) governmental controls, but under the circumstances there was no alternative.

"Indeed, if we must have controls, they certainly are more flexible if set up as an administrative device, rather than if they were written on the statute books in the form of legislation.

"The present system of controls is both good and bad. On the good side we have experienced something of a stabilization in supply, and prices generally are firmer than they were last year.

"It is in the allocation of the total among qualified importers that bad aspects become most glaring.

"The principle has been adopted of allocating import allowables in proportion to the volume of oil run by each refinery. Other relevant considerations have been ignored. The provisions are based pretty much on considerations of politics and largely ignore the interests of established or historic crude-oil importers, which are principally larger companies."

T. S. Petersen, president, Standard Oil Co. of California, in a speech to Standard of California stockholders.

Who will move the oil?

"Four members of the Celler committee, which is a subcommittee of the judiciary committee of the House of Representatives, have signed a report that gives a once-over-lightly treatment to some of the most complex problems affecting the relationship of the U. S. Government to American business.

"In part, it deals with the pipeline business. Nearly all oil and products pipelines, because of their terrific investment cost and high risks, are built by oil companies. Even so, pipelines are considered common carriers and, by a court agreement, can pay no more than 7% dividends to their owner companies. They are required to move competitors' oil as well as oil

HYCALOG V-DOOR DIAMOND DRILL BITS
PATENT PENDING

DRILLS 2814′ IN 13000′ WELL WITH ONE TRIP

In Kenedy County, Texas, a *single* Hycalog V-Door 6⅝" bit stayed on bottom from 10,186′ to 13,000′ T.D. Drilling time was 791.75 hours with an average rate of penetration of 3.55 ft./hr. Conventional bits drilling in this section could do no better than 3 ft./hr. and replacements were *frequent.*

You won't have to do much figuring to estimate the enormous savings in bit cost, in long round trips and rig time.

So, why not let us save you some big money on your next well with Hycalog V-Doors. *And don't forget* HYCALOG GAS CHRONOFRAC *well logging services.*

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BRANCH OFFICES IN PRINCIPAL OIL PRODUCING AREAS

DIAMOND BITS DIAMOND CORING
WELL LOGGING CORE ANALYSIS

Oil and farming combine to make the Kansas countryside an imposing sight. In this area, formations like the Arbuckle and Kansas City Lansing are usually treated with Dowell inhibited acid.

MAKE YOUR WELLS WORTH MORE

Insist On Dowell When You

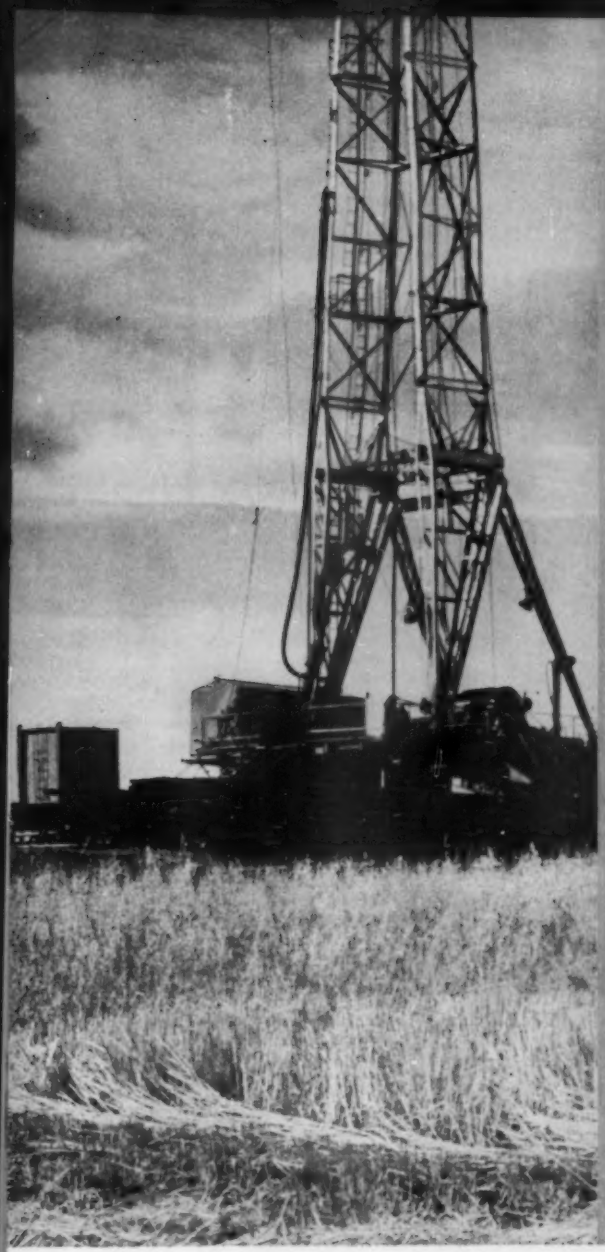
For many well conditions, "regular" inhibited hydrochloric acid gives excellent results. In these wells, addition agents or other auxiliary treating materials are not needed. This means that an operator can get a given size treatment for less money. It can mean a quicker pay-out and more profitable production.

But regular acidizing is not always as simple as it may seem. If addition agents *are* needed and are not used, silicate swelling or emulsions, for example, can actually reduce production. In such cases, remedial work may be required.

To avoid costly treatment failures, many operators use Dowell experience and facilities—on even the "simplest" acidizing jobs. There are many reasons to insist on Dowell:

First, Dowell has had *more* experience than any other company. There are few fields in the United States, Canada, and Venezuela in which Dowell has not had acidizing experience. In some cases, Dowell has acidized old wells three and four times. To you, this simply means that you have a better chance for success when you insist on Dowell.

Second, Dowell engineers are well-trained and familiar with their area. They use this training and knowledge to help assure the success of your treatment. Their record contains a relatively high percentage of successes.



Here Are Some Conditions Where Dowell "Regular" Acid Treatments May Be Your Best Stimulation Buy

If you are re-treating an old well—

—usually the basic drainage channels already exist and only need to be cleaned up and extended. Large treatments using Dowell regular acid have been quite successful in re-treating old wells in many fields.

If your crude does not emulsify easily—

—if both formation characteristics and produced fluid tests indicate no emulsion or other special problems, you may save money or get a bigger treatment using Dowell inhibited acid without other additives.

If your formation is a medium-reacting limestone—

—often, regular acid will provide just the right rate of reaction when it is skillfully injected. Your Dowell engineer can help you decide whether addition agents are needed. In any case, he can help you design a low-cost acid treatment especially for your well.

If you have plastic-coated tubing—

—the chances are you have overcome your iron scale problem. If this is the case, inhibited acid without additives may do the job.

If your problem is not clear—

—or just to be sure, call the Dowell engineer for help. Rely on his knowledge of local conditions and Dowell's experience in well stimulation. Let him turn his expert attention to your problem.

Treat With "Regular" Acid

Third, if the Dowell study of your well problem indicates that addition agents are needed, you will get not only the best additives but the widest variety. Dowell pioneered the development of special acids to combat such problems as silicate swelling, emulsions, iron precipitation, mud contamination, and too-fast reaction rate.

Fourth, you save money with safety when you insist on Dowell.

The success of any stimulation treatment depends on both well improvement and treatment cost. Your Dowell engineer can help you tailor *low-cost* acid jobs to fit your needs.

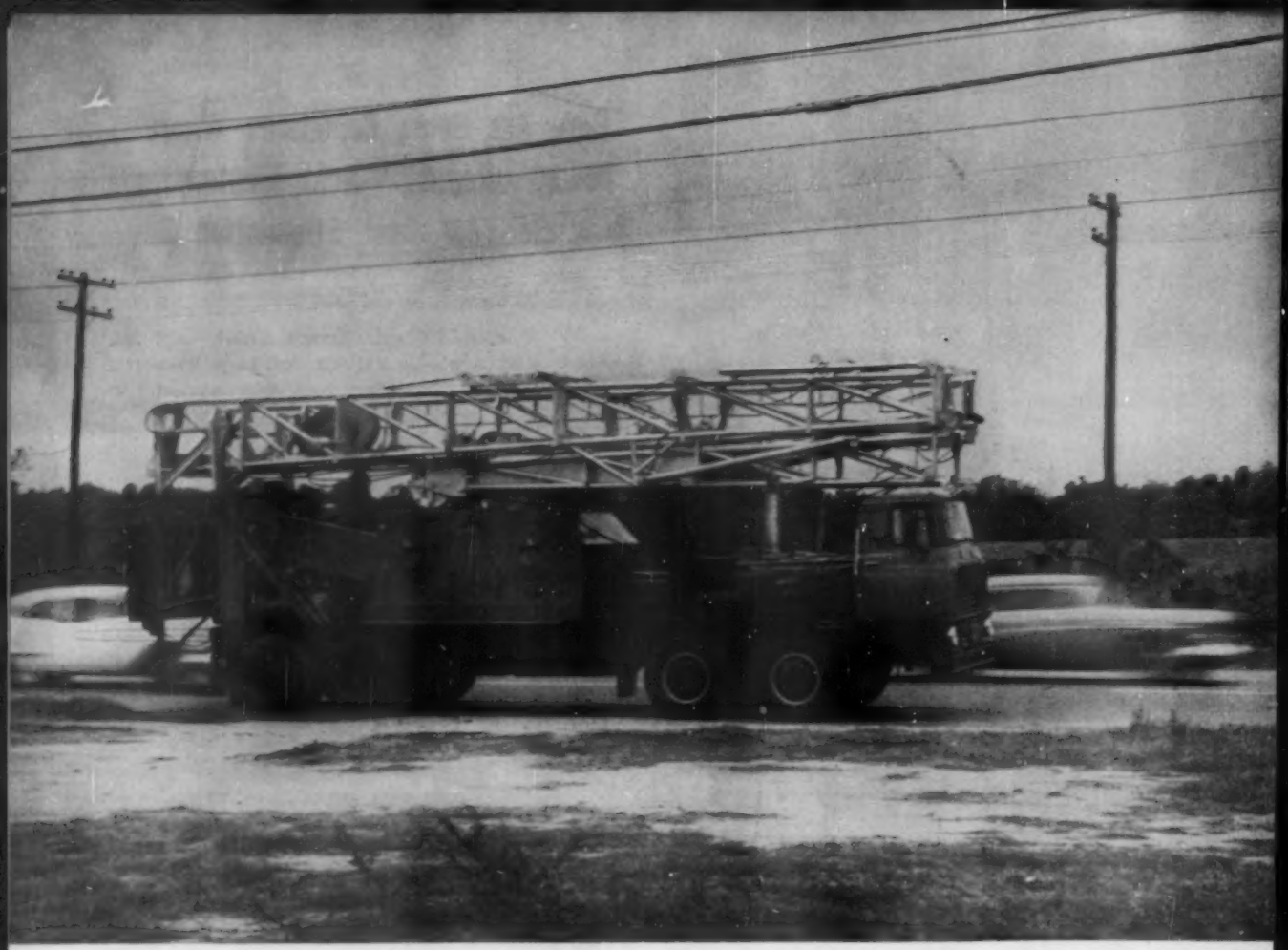
The examples in the box above show several conditions where regular acidizing has provided satisfactory treatment.

For prompt service or detailed information on acidizing or any of the other Dowell well stimulation services, call the Dowell office nearest you. In Canada, contact Dowell of Canada, Ltd.; in Venezuela, United Oilwell Service. Dowell, Tulsa 1, Oklahoma.

Services for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY



Cooper "Licks" Highway Problems with a Completely Legal Doubles Rig

The Cooper model TC self propelled unit, equipped with a Cooper skytop for servicing the deepest wells, has licked the problems of moving a doubles rig over the highways. Lighter weights, axled right for your job, and legal dimensions add up to a truly portable machine that *costs less* than so called portable rigs. The Cooper model TC is easy to keep clean because it's uncluttered. It's rugged enough to withstand heavy oil field use. Get full details from a Cooper salesman or write Box 1890, Tulsa, Okla.

FRED E. Cooper, Inc.

P. O. BOX 1890 TULSA, OKLA.

Branches: Houston, Odessa, Olney

ORIGINATOR OF MOBILE WINCH UNITS

belonging to the owning companies, and they do.

"These four men say that the federal government should not permit a pipeline company to pay dividends on money earned as a result of moving its owner's oil. But more, it cannot pay dividends on money earned from moving a competitor's oil either.

"Since no one can build free pipelines, this eventually means that these four men want oil companies to get rid of their pipelines. They did not suggest a way to get future pipelines built. They did not suggest how small producers of oil, who now use the pipelines on the same terms as their owners, can get their oil to market.

"The report has no official status at all; it shows more evidence of political motives than of understanding or study of the tremendously complicated matters it deals with."

L. H. True, president, Magnolia Pipe Line Co., in a statement to the press.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

JUNE

21-26 American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City.

22-23 Michigan Gas Association, Grand Hotel, Mackinac Island, Mich.

22-24 Canadian Gas Association, annual meeting, Empress Hotel, Victoria, B.C.

22-26 Gordon Research Conferences, petroleum, Colby Junior College, New London, N. H.

22-26 Air Pollution Control Association annual meeting, Statler-Hilton Hotel, Los Angeles.

22-26 Massachusetts Institute of Technology, National Association of Corrosion Engineers, short course on fundamentals of corrosion reactions and corrosion control, MIT, Cambridge, Mass.

24-25 Western Petroleum Refiners Association, Mid-Continent regional technical-industrial relations meeting, Broadview Hotel, Wichita.

26 Southern Gas Association, compressor station conference, Dinkler-Tutwiler Hotel, Birmingham, Ala.

29-July 3 Gordon Research Conferences, catalysis, Colby Junior College, New London, N. H.

JULY

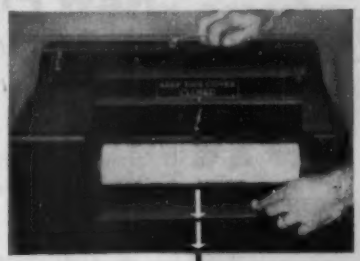
6-15 University of Michigan, short course on underground storage of natural gas, Ann Arbor, Mich.

10 Southern Gas Association, round-table conferences for gas measurement superintendents, chief dispatchers, and gas-conditioning personnel, Mayo Hotel, Tulsa.

16-17 University of Michigan, research conference on underground storage of natural gas, Ann Arbor, Mich.

27-31 University of Minnesota, continua-

transmit **ANY** *data* **ANY** *distance*



with a

FAIRCHILD FACSIMILE COMMUNICATION SYSTEM

• *in minutes* • *without error* • *in sharp detail*

Now you can break the time barrier—intra-plant or coast-to-coast—of interchanging any kind of visual data in volume. With a Fairchild facsimile communication system, planned to serve your specific needs, you can transmit engineering drawings, change orders, blueprints, charts, sketches, memos, schedules, specifications, photos, contracts, invoices, shipping orders, forms, letters. You can use short wave radio, telephone, leased wire or microwave transmission. You can transmit data rapidly and dependably, without error, and with the sharpest detail available today.

Oil and gas industry applications

Petroleum companies can increase the value of the microwave equipment they already have. Champlin Oil and Refining Co. of Fort Worth, for example, uses Fairchild Facsimile to save time in transmitting production reports, shipping schedules and accounting data daily from its Oklahoma refinery. Other uses for the petroleum industry include transmission of run-tickets, geophysical charts and seismograph recording tapes, well-survey and well-log reports, aerial patrol photos, compressor-engine performance cards, etc.

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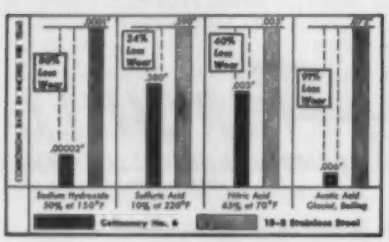

This table shows the comparative resistance to corrosion of Colmonoy No. 6 and 18-8 stainless steel. No. 6 is resistant to almost all caustics and acids. Ask for Engineering Data Sheet No. 3.

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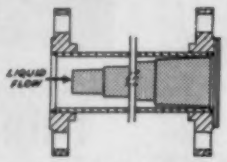

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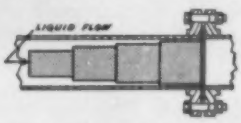

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3-7 University of Minnesota, continuation course, chemical interpretation of infrared spectra, Minneapolis.

10-13 Society of Automotive Engineers, national West Coast meeting, Hotel Georgia, Vancouver, B. C.

10-28 Louisiana Polytechnic Institute, Lou-Ark section of AIME, graduate summer session in reservoir engineering, Louisiana Polytechnic Institute, Ruston, La.

12-15 Billings, Mont., Geological Society, tenth annual field conference, Disturbed Belt area of northwestern Montana, registration, August 12, Great Falls, Mont.

23-26 American Institute of Electrical Engineers, sixth electrical conference of the petroleum industry, Wilton Hotel, Long Beach, Calif.

24-26 West Virginia University, annual Appalachian gas measurement short course, Morgantown, W. Va.

27 Oil Centennial Day, Titusville, Pa.

26-28 Pennsylvania Grade Crude Oil Association and Pennsylvania State University, twenty-first technical conference on petroleum production, Penn State campus, University Park, Pa.

SEPTEMBER

9-11 Pacific Coast Gas Association, annual meeting, Ambassador Hotel, Los Angeles.

9-12 Intermountain Association of Petroleum Geologists, annual field conference, western high Uintas, registration, September 9, Provo, Utah.

10-12 Magic Plains Oil Exposition, Borger, Tex.

14-16 Texas Mid-Continent Oil and Gas Association, annual meeting, Rice Hotel, Houston.

16-18 Wyoming Geological Association, field conference, Big Horn Basin, registration, Cody, Wyo.

16-18 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

17 Natural Gasoline Association of America, Rocky Mountain regional meeting, Wyoming-Gladstone Hotel, Casper, Wyo.

20-23 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Rice Hotel, Houston.

21-25 Instrument Society of America, annual instrument-automation conference and exhibit, International Amphitheater, Chicago.

23-24 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

24-25 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division annual meeting, Roosevelt Hotel, New Orleans.

27-29 National Association of Oil Equipment Jobbers, annual convention and trade show, Hotel Leamington, Minneapolis.

29-30 Western Petroleum Refiners Association, management seminar, Western Hills, Waggoner, Okla.

28-Oct. 1 American Welding Society, fall meeting, Sheraton-Cadillac Hotel, Detroit.

29-Oct. 1 National Association of Corrosion Engineers, western region conference, Bakersfield Inn, Bakersfield, Calif.

OCTOBER

1-2 National Association of Corrosion

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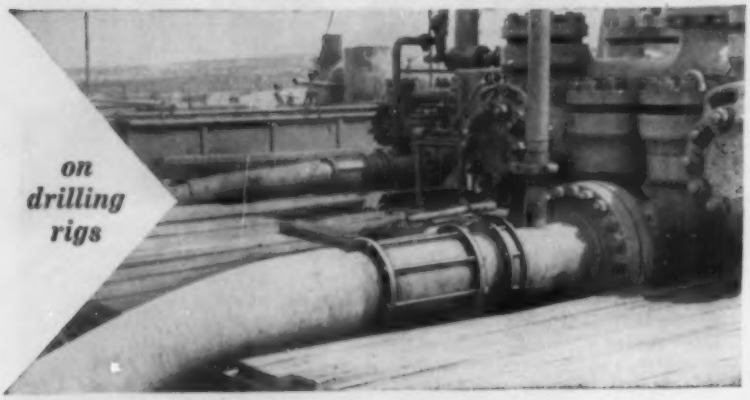

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Engineers, southeast region conference, Jacksonville, Fla.

2-3 Association of Desk and Derrick Clubs of North America, eighth annual convention, Hilton Hotel, San Antonio, Tex.

4-7 Society of Petroleum Engineers of AIME, fall meeting, Memorial Auditorium, Dallas, Tex.

5-7 American Gas Association, annual meeting, Conrad Hilton Hotel, Chicago.

5-7 National Association of Corrosion Engineers, northeast region conference, Lord Baltimore Hotel, Baltimore.

5-10 Society of Automotive Engineers, national aeronautic meeting, aircraft manufacturing forum, and aircraft engineering display, The Ambassador, Los Angeles.

7-8 Western Petroleum Refiners Association, fourth annual stream pollution and waste disposal conference, Broadview Hotel, Wichita.

7-10 Rocky Mountain Association of Geologists, eleventh annual field conference, Saratoga Inn, Saratoga, Wyo.

8-9 California Natural Gasoline Association, annual fall meeting, Huntington-Sheraton Hotel, Pasadena, Calif.

8-10 American Association of Petroleum Geologists, Southwestern Federation of Geological Societies, second annual regional meeting, Coliseum, Lubbock, Tex.

8-10 Southwestern Federation of Geological Societies, annual meeting, Lubbock, Tex.

8-10 Exploration Drilling symposium, sponsored by University of Minnesota, Colorado School of Mines, and Pennsylvania State University, University Park, Pa.

8-11 Louisiana Gulf Coast Oil Exposition, Lafayette, La.

11-13 American Association of Oilwell Drilling Contractors, annual meeting, Skirvin Hotel, Oklahoma City.

11-16 American Society for Testing Materials, Pacific area national meeting, Sheraton-Palace Hotel, San Francisco.

12-15 National Association of Corrosion Engineers, south central region conference, Cosmopolitan Hotel, Denver.

13-14 Seventh Annual Gas Measurements Institute, National Guard Armory, Liberal, Kans.

20-22 American Standards Association, national conference on standards, Sheraton-Cadillac Hotel, Detroit.

20-22 National Association of Corrosion Engineers, north central region conference, Cleveland.

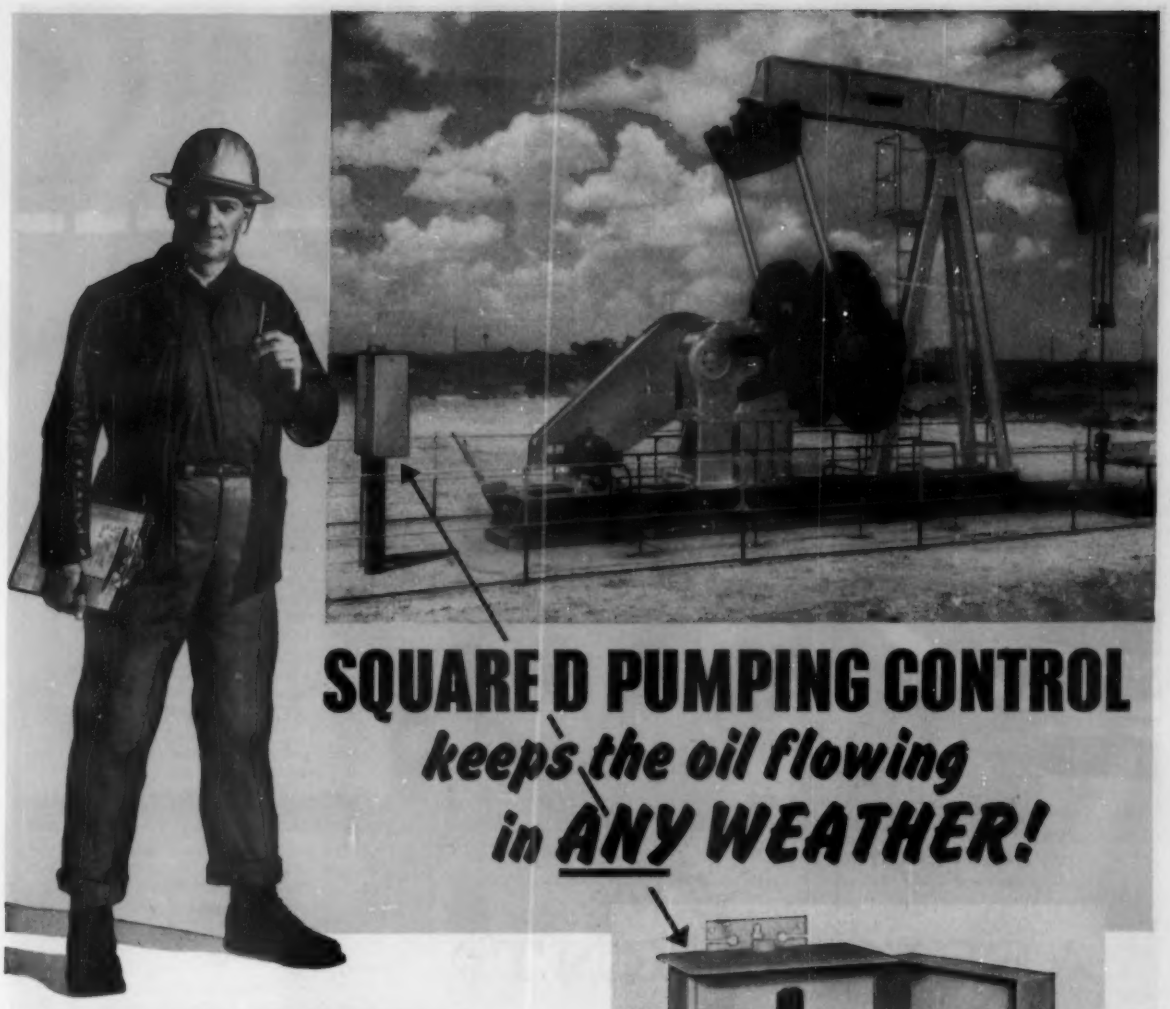
20-22 American Society of Mechanical Engineers, American Society of Lubricating Engineers, lubrication conference, Sheraton - McAlpin Hotel New York.

22-23 American Institute of Mining, Metallurgical, and Petroleum Engineers, Los Angeles Basin section, fall meeting, Huntington Sheraton Hotel, Pasadena, Calif.

23 Natural Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.

26-27 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

26-27 Independent Natural Gas Association of America, annual meeting, Westward Ho Hotel, Phoenix.



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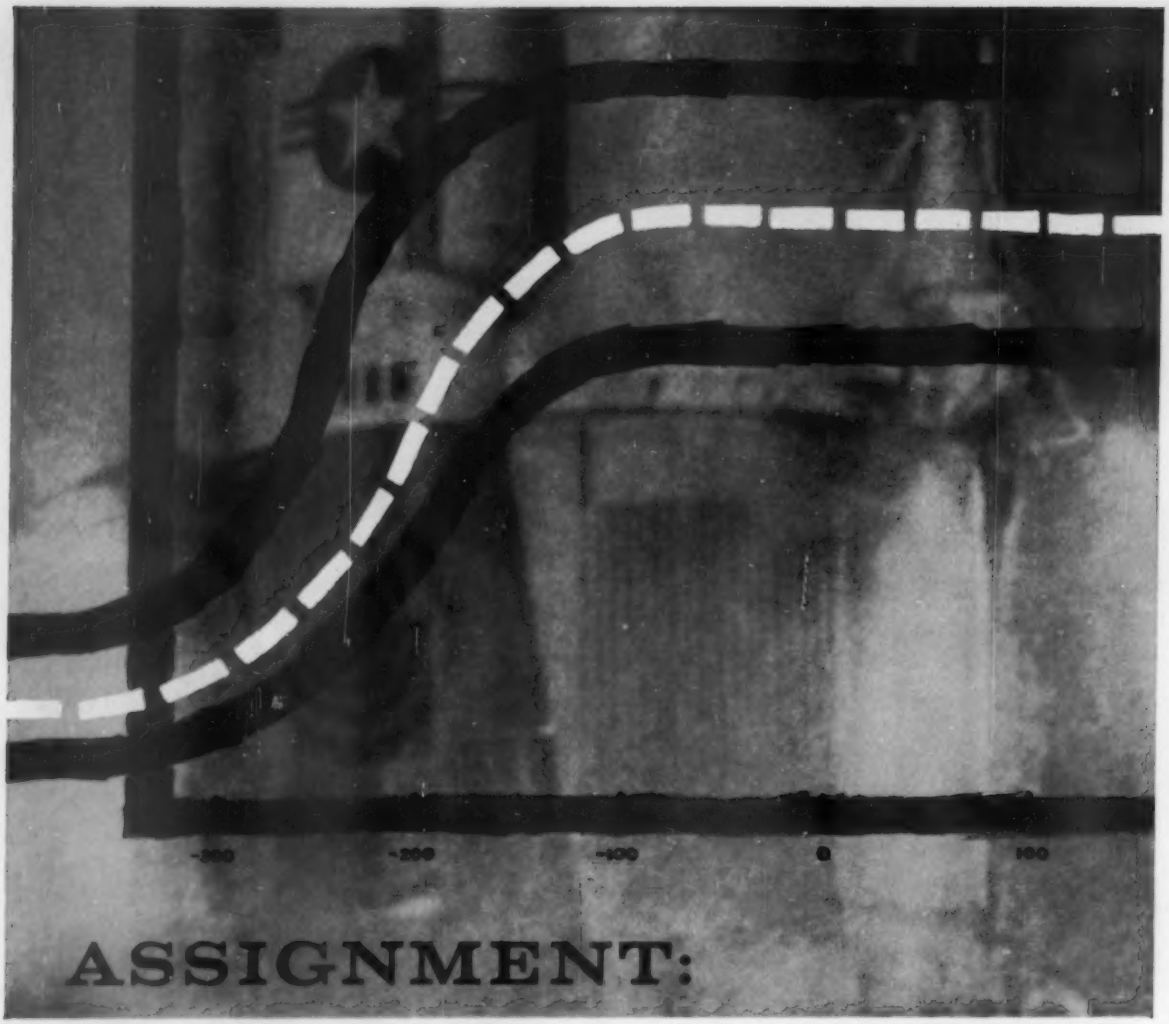

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JOURNALLY SPEAKING

Crude Economics

THE OTHER DAY we heard an independent oil producer expounding about the price of crude oil along this line:

"Let's keep stocks of crude high and avoid any possibility of a cut in the price.

"If we hold down production so that the major companies get rid of their stocks, they'll be tempted to cut the price and stock up again at bargain rates.

"I saw them do that lots of times back in the '20's and '30's. The majors would work their stocks down, cut crude prices, load up their tanks, and then raise the price and make millions of dollars on the markup of their inventory.

"So every time I see crude stocks declining I'm afraid a price cut is coming.

"I say the way to hold the price of crude is keep stocks high."

Our friend was born 30 years too soon. Things don't work that way any more.

No doubt there were times when certain majors manipulated crude prices in certain areas on the basis of their own inventories only. Certainly the folklore of the industry contains many stories about how some companies cleaned up by building big storage in anticipation of a price rise. There are also stories about companies losing their shirts by carrying crude in storage for years awaiting a price rise that didn't come.

Those were the days before conservation practices stabilized production, before the world realized the magnitude and importance of underground reserves, before the industry began collecting figures on supply and demand.

The oil industry was obsessed with the idea that there was going to be an oil shortage. So most refiners and pipeline companies carried huge stocks of crude. Big tank farms holding millions of barrels were common sights throughout the oil patch.

In 1923 U.S. refiners had 240 days' supply of crude in storage—they could have run more than half a year without another barrel being produced. From 1926 to 1933 they carried about 150 days' supply in stock.

Today crude stocks are around 260 million barrels, which is about 32 times the current daily refinery runs. This is much less than a month's supply because much of the total is unavailable, being pipeline fill, tank bottoms, and working inventory.

Today the industry just doesn't have tank space for huge crude stocks. It doesn't want to carry big inventories, and doesn't need to. A network of pipelines and the system of exchanging crude gives most refiners many alternate sources of supply. Crude production can be increased quickly in case of an unexpected spurt in demand. Crude inventories are costly and wasteful. Today the industry is geared to a hand-to-mouth crude-oil economy.

Even more important is the fact that today most all major companies are integrated and own huge underground reserves of their own—something that was not so generally true of refiners 20 and 30 years ago.

This means that if a major company cuts the price of crude it cuts the inventory value of every barrel of its proved reserves—which may be the biggest asset on its books. The dollars involved in its aboveground stocks of crude are usually peanuts compared with the value of its underground reserves affected by any change in the price of crude.

Our friend should bring his economic reasoning up-to-date. Today the price of crude is determined by what refiners can get for the products they make out of it. The price of petroleum products is determined by the quantity available in relation to the demand.

When, as is the case right now, there are surpluses of refined products, some refiners shave prices to move their goods. Competitors come down to keep the business. Pretty soon most refiners are showing little profit. So to break even they look for cheaper crude, and some may cut crude prices. Their decision to cut is influenced little, if at all, by the size of their own crude stocks.

Today producers should watch products stocks rather than crude stocks as the key to crude-price movements. It is high products stocks—not low crude stocks—that carry a threat to crude prices.

—Henry D. Ralph

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There's only one way left to end oversupply

MUCH TO SOME PEOPLE'S SURPRISE, all ills of the domestic oil industry did not evaporate when limitations were imposed on imports.

In looking around for a cause it should be obvious that the basic trouble is still general oversupply—in spite of the fact that the foreign portion of the supply has been cut down to reasonable size.

And in looking around for a remedy it should be obvious that far too large a portion of domestic production lacks the stabilizing and restraining influence of sound conservation and proration regulation.

EXCESS PRODUCING CAPACITY in this country exceeds current demands by an amount greater than the total volume of imports in any year. Unless it is held in check, imports could be cut to zero without attaining balance.

Bitter experience over many years has shown that the only way to hold supply in check is through state conservation laws that put restraints on flush production through various devices—most effectively through market-demand proration.

The federal Government has endorsed and adopted this principle in its imports-control plan. It limits foreign supply to a specific percentage of demand and prorates that total among importers.

The domestic industry should do likewise—must do so if there is to be any end to oversupply. Only five important producing states attempt to correlate output to requirements, and their percentage of the total supply is not enough to maintain a balance.

It is not only unfair for five states to do the job—it's impossible. As the prorating states cut back, development booms and production zooms in other areas. And the unneeded output of these other areas is threatening to destroy the stability of prorated and unprorated alike.

HERE'S A CURRENT EXAMPLE. In Kentucky, which has no regulations whatever, scores of new oil men have brought in additional shallow production, which is probably short-lived. But for the present at least, this output is so large that it threatens to wreck the market for Illinois crude. The whole market is so precarious that a relatively few extra barrels can upset the whole thing.

Since Illinois also lacks regulation, it can do nothing to offset this augmented supply in its area market. A slump in the Illinois-basin market will quickly be reflected westward through the pipelines to the Rockies area which likewise is powerless to tailor supply to demand.

These nonregulating states cannot forever expect the prorating states to keep moving over to give them all the room they happen to want.

Today there just isn't room for all the domestic oil seeking a place in the market. Instead of moving over more, the prorating states ought to exert great pressure in every quarter to bring other areas to modern conservation practices that include some sensible restraint on output.

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● Several conditions encountered down the well which could prove to be sources of trouble and expense can be readily avoided by placing a dependable Lone Star cement slurry back of the strings of pipe.

In the Gulf Coast, East Texas and similar areas, certain conditions can cause endless trouble, such as:

Contamination by oil-well fluids of fresh water sands near ground surface.

Hazards of gas seepage from high pressure gas formations to low pressure or dry sand formations.

Water leaks at the bottom of the well, causing a mixture of water and oil to come in, making necessary expensive remedial squeeze jobs.

Migration of well fluids from water sand to oil sand or vice versa.

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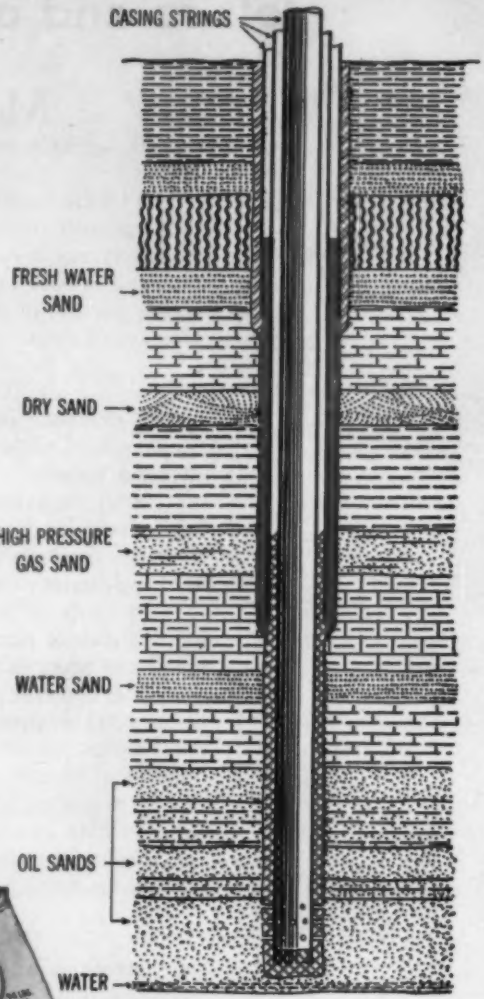

Oil well conditions typical of those encountered in the Gulf Coast, East Texas, and similar areas.

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OPERATING in the Gulf of Paria is Offshore Co.'s floating drilling barge, the D-1.

Going Abroad? Try an Offshore Site!

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A HALF-MILLION dollars will drill you a well abroad—but only if you drill offshore.

That sounds like a mouthful, but there's one oil operator who produces figures to show it can be done.

The half-million is for a single well located, say, somewhere on the Continental shelf north of Venezuela and south of the U. S. In fact, you might cut under that half-million by $50,000.

And the beauty of it is that, if you don't like what you find, you can sail home and leave no capital investment to rot and rust in the jungle.

A. J. Laborde, president of Ocean Drilling & Exploration Co., is one strong advocate of foreign offshore drilling.

Laborde's thesis: It is cheaper to drill offshore than onshore in many areas of the world. And the chances of finding oil are just as good.

The full story may not be quite as simple as that. There are pitfalls for the uninitiated. But to Laborde the basic premise is sound.

ODECO's job . . . Since last July, ODECO has been gathering know-how in foreign offshore drilling at a spot fairly close to home—Mexico's Bay of Campeche.

The "El Dorado" drilling barge moved into Campeche under a drilling program with the Pauley interests and has sunk its eleventh well. The cost to date: $2.5 million to $3 million.

How does ODECO do it?

For one thing, the operation is based largely in New Orleans, not Mexico. The crews who work the "El Dorado," 850 miles from home, live in New Orleans and fly to work and back. The New Orleans office is in touch with the rig by radio.

The men go from New Orleans to Campeche by air in the time it takes to go by boat to some Louisiana offshore platforms. It's 2 weeks on and 2 off, and neither the man nor his family is aware of any great difference. The crewman is home the same amount of time.

Basically, what makes such an offshore operation attractive is that an offshore barge like the "El Dorado" is a largely self-sufficient, self-contained package. It has sizeable storage capacity for mud, fuel, pipe, and other equipment, makes its own water, and has complete living quarters, large cold storage area, and other facilities required for living and working offshore.

In other words, what is needed to

Rule-of-Thumb Cost of Foreign Offshore Well

...according to ODECO President A. J. Laborde

Move rig to site	$100,000
Drill for 30 days	$250,000
Move rig out	$100,000
Total	**$450,000**

drill a well can be placed on the barge at one time. Furthermore, supplies can be replenished easily because the barge always can be reached by water.

Most places in the Western Hemisphere are within a few hours boating distance from a regular steamship and airline port of call.

Drilling ashore . . . Compare the "El Dorado's" operation with one on land.

In most instances, says Laborde, you have to hack a road through the jungle to the drillsite. You have to build a camp. You move in the families. You have heavy overland transportation costs. Or you spend a fortune flying in a rig.

But with a comparable offshore operation, you can move a complete self-sufficient rig to the site for $100,000, drill 30 days for another $250,000, and, if you want to abandon and come home, you can do that for another $100,000. Total cost: $450,000.

Where, Laborde asks, can you find a foreign operation onshore that has been spudded for twice that amount —let alone drilled a well and returned home?

What's more, many foreign drillers who have invested large sums in permanent inland camp installations have a tendency to spend still more money against their better judgment.

For example, Laborde says, an operator drills a dry hole and wishes he had never gone abroad in the first place. But he has persuaded management to commit 4 or 5 million dollars to the venture. So, in that situation, he might be more apt to throw good money after bad by drilling more dry holes in an unsuccessful attempt to protect the original investment.

Louisiana comparison . . . What about Louisiana—an offshore drilling area in Laborde's own backyard? Why go abroad?

While drilling has improved in recent weeks in Louisiana waters—and ODECO had all its rigs working even before the upturn—there are important economic differences between offshore drilling in the U. S. and in foreign areas which have no production.

Laborde points out that it costs big chunks of money to get Louisiana leases, and, when they finally produce, the low allowables make it difficult to get an adequate return on investment.

On the other hand, concessions in nonproducing foreign areas are obtainable for a song. The country itself would be a market for any production developed, and allowables would be virtually nonexistent.

Therefore, the payout on a good discovery might be many times shorter than it is off Louisiana.

Location . . . The ideal drilling spot, from the standpoint of cost, is one in the Caribbean area near a Louisiana home base, where offshore drilling equipment is now centered.

To move farther would cost more.

But, here again, Laborde contends the principle of cheaper offshore drilling still is valid. It might cost half a million dollars to move a drill barge to Indonesian waters, but, once there, cost of sinking a hole offshore would be much cheaper than setting up permanent installations in the remote interior.

The only difference is that a larger drilling program—not a one or two-well venture—would be required to make it worth the risk.

New wrinkle . . . Something new is being added to offshore drilling which, Laborde suggests, may make foreign operations of the kind he describes even more attractive.

Floating drill barges, which require no fixed platform and make drilling easier in very deep waters, already are a reality. With a few more refinements, they will become a fixture in the industry.

They will be handy for use in little-tested areas of the world because they are particularly adaptable to core drilling.

Another view . . . There are two sides to the coin, and there are many dangers inherent in foreign offshore drilling.

For one thing, the smaller independent should recognize that a 9-to-1 failure ratio can quickly devour him. One leading offshore operator says the independent would be playing it safer to participate in a joint venture rather than going it alone.

For another, once oil is found, the producer will find that development is much more costly than it is onshore. Platforms and underwater gathering lines are expensive, and the problem of constant supply by water mounts rapidly.

Airlift cargo planes, for example, collect $200 to $400 per hour.

More cost data . . . Another offshore competitor, Offshore Co., Baton Rouge, which operates 19 offshore platform rigs and inland barges, has done considerable water drilling abroad.

Offshore also has run some comparative costs on offshore and inland drilling in Nigeria, on Africa's west coast. The comparison was close.

While out-of-pocket costs were less in offshore drilling, the fixed costs for the expensive offshore rig—depreciation, overhead, insurance—made the figures nearly even with onshore.

The Offshore organization, however, has been sharpening its pencil and now believes it can show where drilling on water can be done more cheaply than on land.

"We can send a unit abroad cheaper and do the whole job," Offshore says. "We can't tell the method. It's a matter of putting known quantities together in the most efficient manner.

"Oil men very definitely should look into offshore drilling abroad. The costs are very comparable, and they practically give you the concessions."

Where to drill . . . Both ODECO's Laborde and Offshore's spokesman can grow rapturous pointing to the spots around the earth where offshore drilling has prospect of finding oil.

Currently, the only major offshore producing areas are in the U. S., Venezuela, the Caspian Sea, and the Persian Gulf. ODECO's "El Dorado" barge may also have a major find for the Pauley interests off Mexico in the Bay of Campeche.

But vast offshore areas around the globe contain geologic structures awaiting the oil gambler's drill bit.

Some oil men believe the shallow waters of Indonesia, where oil has long been produced on land, offer the best prospect for the offshore driller.

Also the nearby waters of the Bay of Bengal, Burma, northern Australia, and New Guinea look alluring.

Africa's west coast, where the Sahara desert stretches to the coast of French West Africa and Spanish Sahara, may some day draw the wildcatter. Equatorial Africa already is gaining attention.

There are spots in Europe—from the North Sea to the Mediterranean—that hold promise.

The Caribbean, from Colombia to Cuba, and the coastal waters of the adjacent West Indies have been tested a good many times in recent years, but there are literally hundreds of other locations which warrant a try for oil.

These and other areas of the world await the offshore driller who wants to take a flyer into foreign exploration at a price which, according to ODECO and Offshore, is less than an operation on land.

RIG hauled over muskeg by Bombardier tractor, and . . .

SEISMIC drilling gets under way.

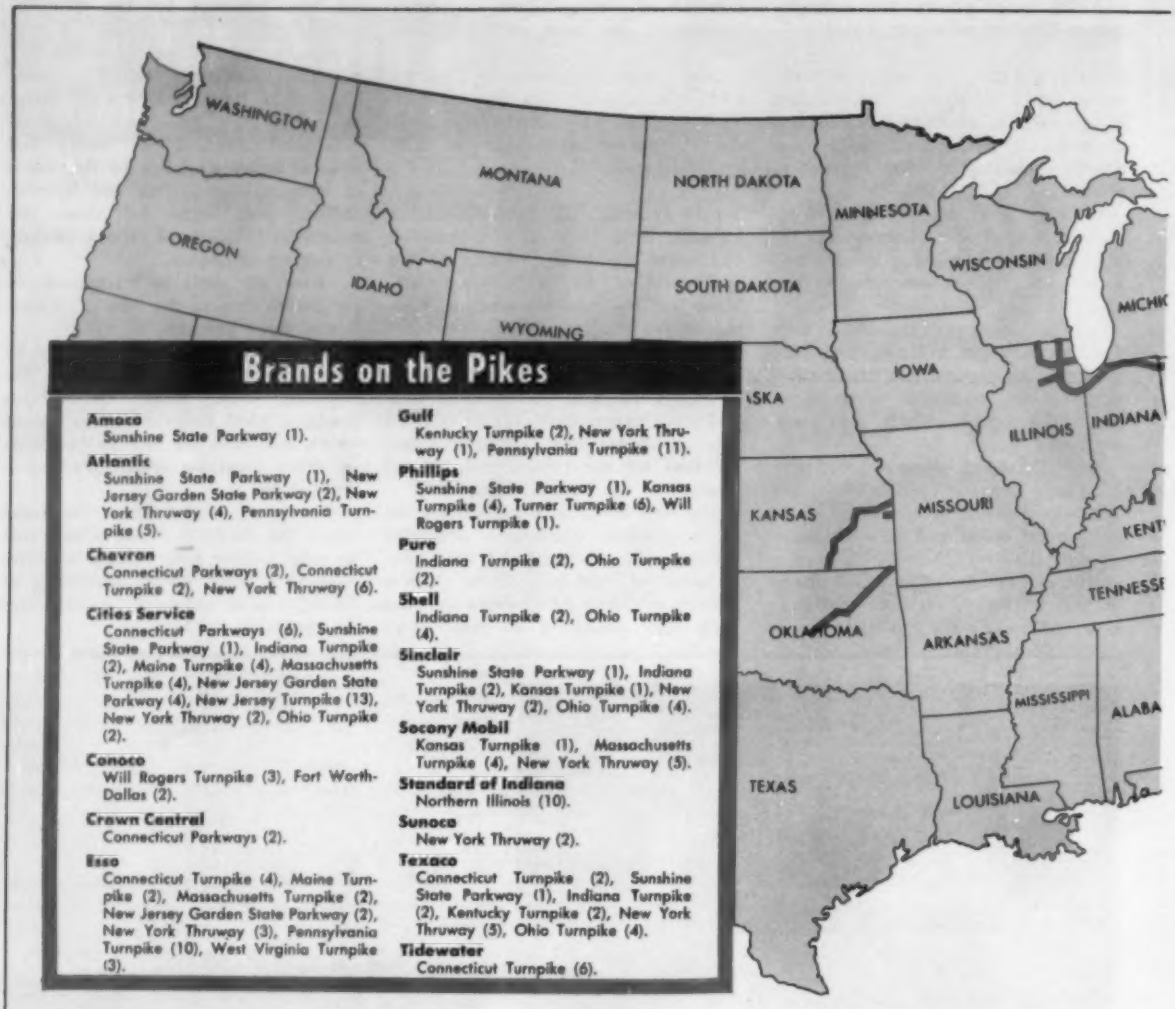
Tandem Tractor Aids Oil Search in Muskeg

ANOTHER vehicle designed to conquer the muskeg barrier to summer exploration in northern Canada is being used by British American Oil Co.

It's a tandem tractor, the Bombardier "MM," built by Bombardier Snowmobile, Ltd., Valcourt, Que. B-A is the first oil company to use the tractor, which was field tested in the Berland river area of northwestern Alberta.

The tractor has a maximum loaded weight of 10 tons. It can carry a shot-hole rig capable of drilling to 1,500 ft. Fully loaded, it maintains a ground pressure of less than 2 lb. per square inch—less than that exerted by a man. The two units of the "MM" tractor are powered by a 172-hp. V-8 engine.

A B-A spokesman says the company feels the tractor is the answer to the problem of its seismic crews being bogged down when Canada's northern muskeg thaws and turns to mud.



Brands on the Pikes

Amoco
Sunshine State Parkway (1).

Atlantic
Sunshine State Parkway (1), New Jersey Garden State Parkway (2), New York Thruway (4), Pennsylvania Turnpike (5).

Chevron
Connecticut Parkways (2), Connecticut Turnpike (2), New York Thruway (6).

Cities Service
Connecticut Parkways (6), Sunshine State Parkway (1), Indiana Turnpike (2), Maine Turnpike (4), Massachusetts Turnpike (4), New Jersey Garden State Parkway (4), New Jersey Turnpike (13), New York Thruway (2), Ohio Turnpike (2).

Conoco
Will Rogers Turnpike (3), Fort Worth-Dallas (2).

Crown Central
Connecticut Parkways (2).

Esso
Connecticut Turnpike (4), Maine Turnpike (2), Massachusetts Turnpike (2), New Jersey Garden State Parkway (2), New York Thruway (3), Pennsylvania Turnpike (10), West Virginia Turnpike (3).

Gulf
Kentucky Turnpike (2), New York Thruway (1), Pennsylvania Turnpike (11).

Phillips
Sunshine State Parkway (1), Kansas Turnpike (4), Turner Turnpike (6), Will Rogers Turnpike (1).

Pure
Indiana Turnpike (2), Ohio Turnpike (2).

Shell
Indiana Turnpike (2), Ohio Turnpike (4).

Sinclair
Sunshine State Parkway (1), Indiana Turnpike (2), Kansas Turnpike (1), New York Thruway (2), Ohio Turnpike (4).

Socony Mobil
Kansas Turnpike (1), Massachusetts Turnpike (4), New York Thruway (5).

Standard of Indiana
Northern Illinois (10).

Sunoco
New York Thruway (2).

Texaco
Connecticut Turnpike (2), Sunshine State Parkway (1), Indiana Turnpike (2), Kentucky Turnpike (2), New York Thruway (5), Ohio Turnpike (4).

Tidewater
Connecticut Turnpike (6).

Toll Roads Are a Big Gamble for Oil

• Some turnpike service centers are money makers, but the trend appears to be against profitable operations on the toll roads.

TOURISTS on the nation's turnpikes this summer are being treated more than ever before to the ultimate in petroleum marketing.

Service centers along the 3,210 miles of toll roads in the country are geared to give the motorist quick, courteous service, help him in an emergency, and offer clean rest rooms. Some more elaborate centers offer a snack bar or full-scale dining facilities.

But what the motorist enjoying this royal treatment may not know is this: Most likely the expensive layout is returning very little if any profit to the owner.

Current trend, in fact, is more than ever against a profitable operation of the flashy turnpike service centers.

What's wrong . . . Marketing executives told reporters of The Oil and Gas Journal that profits on the turnpikes are squeezed by:

. . . High royalty rates.

. . . Faulty engineering estimates on traffic and patronage.

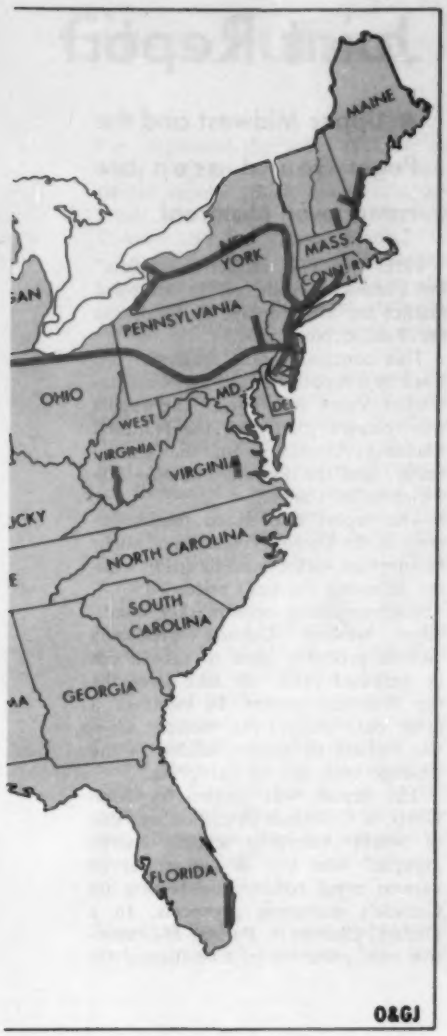
. . . High operating costs and heavy investments.

One of the real sore spots is the royalty paid to the various state turnpike authorities. These rates range all over the map.

The highest rate is 9.35 cents a gallon on gasoline plus $500 monthly rental at two Chevron stations on Merritt Parkway in Connecticut.

Low apparently is Atlantic Refining's deal for three stations on the Delaware River extension of the Pennsylvania turnpike. The royalty is 1.03 cents a gallon on gasoline, 1.11 cents on diesel fuel, 15 cents a gallon on motor oil, and 15% of other gross sales.

There is one big difference, however, Atlantic was required to build the service center facilities at its own expense. That's true of all the other low-royalty areas such as the Maine



O&GJ

Marketers

turnpike, the Turner and Will Rogers turnpikes in Oklahoma, the Northern Illinois toll road, and the various sections of Pennsylvania turnpike.

One veteran marketer observed that royalties weren't bad when the first stations went in on the Pennsylvania turnpike in the 1940's. But he added: "Since then, each turnpike authority has tried to get better and better deals. The trend now is against an economical operation for oil companies on the turnpikes."

The tendency of turnpike authorities to push up the royalty rates is exemplified in Oklahoma.

On the Turner turnpike between Oklahoma City and Tulsa, Phillips Petroleum won the right to build six outlets and operate them at a royalty of 2.5 cents a gallon on gasoline, 1.5 cents on diesel fuel, and 4% of gross on other sales.

Only a few years later when the Will Rogers turnpike between Tulsa and Joplin, Mo., was built, Phillips won a single outlet at a royalty of 5.81 cents a gallon at 6% of gross. Continental got three outlets on the same toll road. It pays royalty of 3.26 cents a gallon plus 6% of gross at one station and 3.51 cents and 8½% at the other two.

Price controls . . . Another "disconcerting trend" among toll-road authorities is price control.

One marketer told the Journal that some states are trying to link prices charged on the expressways with those of neighboring off-road stations.

Generally, gasoline prices on the toll roads are about 1-cent higher than those at off-road stations. The margin depends on the policing by various authorities and varies from state to state.

Marketers contend they are forced to charge more on the toll roads because the service centers there give much better service, represent a higher investment, and are more costly to operate than second-class stations.

High operating costs and heavy investments required force a high "break-even" point for the turnpike stations, and explain why the companies try to get more for their gasoline.

One major who got into the early toll roads estimates its investment will average $250,000 per unit. Other executives say the average investment nation-wide in toll-road stations is nearer $1,000,000 per unit. Standard of Indiana probably has the highest investment with $13,500,000 spent in five service areas on the Illinois toll road.

Two eastern executives estimate a turnpike station must do at least a 1,000,000 gal. worth of business a year to break even. This compares with gallonage of 350,000 to 400,000 annually for a "good" off-road station.

One of these men observed that most of the turnpike stations are company owned. This allows the company to save the dealer margin and offset to some extent the royalty. However, he declared that his company's break-even point, excluding royalty, is about 7 cents a gallon. If costs go to 8 cents, the station definitely is a marginal operation. If costs hit 9 cents, it's a certain loser.

Poor guesses . . . One pet peeve of oil marketers who've invested on turnpikes is the often over-optimistic engineering estimates furnished by the state authorities.

The oil companies made their bids for turnpike spots on the basis of engineering estimates of expected traffic and patronage. Often these have proved faulty. Traffic was less than estimated, and so was business at the pump. Gallonage is tied to traffic on the toll roads as it is everywhere.

Guessing at gallonage which will result from the estimated traffic is also very tricky. One major marketer estimated it would do 4,800,000 gal. on the Ohio turnpike, but sales last year hit 7,600,000 gal. The company had a similar pleasant surprise in New York but missed badly in guessing on Indiana, Kansas, and Florida turnpikes.

Estimating costs also will vary. At one Ohio station a company estimated its cost at 6.22 cents per gallon above the royalty. Costs actually averaged 4.86 cents. But at another spot where the cost estimate was 6.12 cents, actual cost was 7.29 cents. The vast difference between actual costs at the two spots is largely attributable to different gallonage.

Who's profiting . . . All is not gloomy on the turnpikes by any means.

Some of the stations are profitable ventures. Many of those that aren't have values to their companies which offset the financial cost.

Oil companies are understandably reluctant to reveal their financial secrets. But oil men agree that Cities Service and Esso probably have the most profitable turnpike business. Cities Service has the most outlets—38 units—with 13 of them on the heavily traveled New Jersey turnpike. Esso has 28 outlets with 10 of them on the Pennsylvania turnpike.

One major marketer on the Ohio turnpike gave this rundown on its average station: Motor fuel sales totaling 2,357,568 gal. annually split among regular 1,054,761 gal., premium 757,154, and diesel 545,653. In addition, the station sold 9,076 gal. of branded motor oil, 1,206 gal. of other motor oil, $45,423 worth of TBA, and $4,792 in other sales. The operating expenses above royalty and administration were $120,288, leaving ample margin for a profitable return on investment.

Another oil company which has turnpike outlets both in the East and West says flatly it is losing money at every one of its toll-road stations.

Probably the worst experience is being suffered on the Fort Worth-Dallas turnpike where Continental has two service stations on a 30-mile stretch.

Traffic over this toll road is about half what engineers estimated—only 6 million units in 1958 compared with an expected 11.3 million. Also the service stations aren't getting patron-

TYPICAL of excellent service stations now dotting the nation's turnpikes is this Cities Service center on the New York Thruway. Cities Service has 38 outlets on turnpikes, the most of any U. S. oil marketer.

age from "through" motorists due to the short length of the expressway. Motorists can get on with only part of a tank of gasoline and won't need service until they're off.

Conoco sells its gasoline at the two turnpike stations at the going prices for major-brand gasoline in the Fort Worth-Dallas area. Actually, the great bulk of its gasoline sales are to local residents in the Arlington and Grand Prairie region.

Other benefits . . . The turnpike stations have an advertising, promotional, and prestige value which tends to offset some of the marginal operations.

They also often have proved good training centers for marketing personnel.

One executive reports the advertising value of the stations is much greater than originally thought. He says, for example, that Cities Service has picked up much marketing strength south of the New Jersey turnpike since it got exclusive station rights.

The advertising value of the toll-road stations also has a seamy side. One marketer observes the stations are good advertisement only when they are operated well and a liability if sloppily run.

The same is true of the station's use as training ground for marketing personnel.

Cities Service has had excellent results in using its stations as training centers. Some 60% of the original employes of the New Jersey turnpike were college graduates. Forty of them have gone on to company sales jobs and other marketing operations. Another 25 have become operators of Cities Service stations elsewhere. They have turned out to be the company's best dealers.

But another company discontinued using its turnpike stations as training spots. It found the men picked up an unrealistic attitude on service-station operations. They were misled by the volume, high individual purchases, and plush operations on the toll-roads.

Probably the greatest side benefit from the stations, besides advertising and prestige, is offering continuity of service to the company's customers. That's reason enough to lead many majors to try to get outlets on the big roads.

The future . . . What the chances are for more toll roads is a matter of dispute.

Many marketers feel that their volume of business on the present roads will grow. They also think that the present interstate highway program will curtail the turnpike movement. Others believe the trouble being experienced by the Government in financing the interstate program could cause a swing to toll-road type of financing in the future.

If new toll roads are built, at least the marketing men at Jersey Standard feel the method of allocating stations should be changed. They feel the present monopoly system does not give customers the brand of their choice and eliminates the benefits of competition.

Joint Report

• Upper Midwest and the Puget Sound area are rated over Montreal.

THE "MOST attractive outlets" for Canadian crude oil in an open market are Minneapolis, St. Paul, and the Pacific Northwest.

This conclusion was presented last week in a report on "Oil and Canada-United States Relations." The report was released jointly by the National Planning Association of the United States, and the Private Planning Association of Canada.

The report also noted that refineries in the Detroit-Toledo area might be supplied with Canadian crude without affecting the field price.

But, assuming open-market conditions, western Canada producers "would probably have to take a cut in wellhead price" to take over the big Montreal market. In event of a price cut, crude from western Canada "would be readily salable in the Chicago area and in California.

The report was written by John Davis, a Canadian described as "one of North America's leading energy experts," who also is the author of various royal commission reports on Canada's economic prospects. In a preface, Charles A. Perlitz, Jr., executive vice president of Continental Oil

B-A President

CANADIAN oil production is expected to hit a new high this year.

Two developments, exemption of Canadian oil from U. S. import restrictions and increased domestic demand, should kick production over 500,000 bbl. per day, which was Canada's previous peak, reached in 1957.

This optimistic prediction was made by E. D. Brockett, president, British American Oil Co., Ltd., last week. Brockett was one of five B-A officers to discuss Canadian oil in general and British American affairs in particular before the twelfth annual convention of Financial Analysts Societies in Montreal.

Brockett sees exports exceeding 100,000 bbl. per day this year, which are close to the Suez crisis figures of 1956 and 1957. Nominations for

Cites Future Markets for Canada's Oil

Co., expressed the belief that the oil study "represents an objective economic report which takes into account the mutual interests of both Canada and the United States."

In addition to U. S. markets, British Columbia and southern Ontario also are listed among the most attractive outlets for Canadian crude in open-market conditions.

Pointing out that the demand for products in Minnesota, Wisconsin, and Michigan is equivalent to about 950,000 bbl. of crude daily, the report stated that long-term prospects for additional Canadian sales are "encouraging" in the area. "Canadian oil may also penetrate the larger markets" in Illinois, Indiana, and Ohio, it added.

Davis foresees import demand totaling about 1,500,000 bbl. a day in the U. S. Middle West and West Coast by the mid-1960's.

"Even if producers in western Canada succeeded in capturing no more than one-third of this market," he said, "they could be exporting as much as 500,000 bbl. a day by the mid-1960's." This represents more than three times the amount sold to the U. S. in 1957 and about six times the volume in 1958.

Montreal line . . . Davis pointed out that increasing attention has been drawn in the past 2 years to the possibility of building a trans-Canadian crude pipeline serving Montreal refineries with crude from western Canada. These refineries, which account for about 40% of Canada's crude throughput, are now dependent solely on foreign crude, principally Venezuelan.

Cost of a crude-oil line from Central Alberta to southern Quebec has been estimated at $340 million to $400 million. Davis said there is little likelihood that the project could be built as a purely commercial venture.

"Government participation of one kind or another would probably be involved," he said.

"Critics of such a project have been quick to point out some of its economic shortcomings," the report continued. "They state that Canadian oil, in venturing so far afield, would expose itself unduly to foreign competition. On arriving on the East Coast, it would be up against Venezuelan crude, brought in over about the same distance by tanker. It would also have to contend with Middle East oil, the wellhead price of which is tending to fall relative to that in effect in North America."

Before satisfactory arrangements for financing and constructing the pipeline could be made, Davis said, refiners would have to sign supply contracts for about 250,000 bbl. of crude daily over a period of 15 to 20 years. Refiners, however, would be "reluctant" to sign unless the Canadian Government removed "any question of competition from foreign crudes" and perhaps imposed barriers against product imports. The U. S. now accounts for a large percentage of refined products imported into Canada.

Davis indicated that pressure for the cross-Canada pipeline has diminished since the U. S. relaxed restrictions on the importation of Canadian oil.

He said that "there are grounds for believing that even those who have strongly favored protective measures for the U. S. oil industry would not be seriously averse to seeing continuing and unrestricted access for competitive Canadian oil in U. S. markets."

The report on oil is one of two reports authorized by the Canadian-American committee, which was established in 1957 to study problems arising from the growing interdependence between Canada and the United States. A similar study on natural gas is now nearing completion.

The committee, totaling about 60 members, is sponsored by the two nonprofit research organizations in Canada and the United States.

Expects Canada to Set Production Record in '59

Western Canadian crude by U. S. refiners have already shown a considerable increase, he said, and its inherent competitive advantage over U. S. crude in the Puget Sound area and in the north central U. S. augurs continued growth over the longer term.

Brockett pointed out production of 500,000 bbl. per day would be far short of Canada's potential of nearly 1,000,000 bbl. He said B-A has not opposed a crude line to Montreal, but did advocate that it be based on sound economics with no artificial trade devices. "All our studies," he added, "have indicated that such economic feasibility cannot be achieved."

Refining booms . . . D. L. Campbell, senior vice president, sees danger in Canada's expanding refining capacity. It increased 55,000 bbl. to 885,000 bbl. last year. Another 56,000 bbl. will be added this year and 63,000 bbl. more is projected for 1960. This means Canada will have greater than normal excess capacity for some years to come. Lack of restraint in building and operating will aggravate unfavorable price situations.

All six B-A refineries have cat reformers and all but Calgary are equipped with cat crackers and hydrogen desulfurizers. Alkylation has been included at Port Moody and will be added at Clarkson. Both Port Moody and Clarkson have distillate desulfurizers as well. Refining has become so complicated, he said, that it would cost about $1.5 million to improve gasoline quality by 1 octane number at Clarkson alone.

Campbell expects refinery runs for Canada to average 700,000 bbl. daily this year, compared with January 1 capacity of 885,000 bbl. and expected year-end capacity of 941,000 bbl.

Sales up . . . L. R. Woolsey, general manager of marketing, said that while industry sales increased 2% in 1958, B-A sales increased by 9%.

Thus far in 1959, he added, sales have increased about 10%, abetted to some degree by special contract sales. Because of the latter, he questions if the year as a whole will witness such a gain.

Woolsey wound up with a bit of crystal-ball thinking: In 1957 Canada's demand for oil products was 251 million barrels. By 1975, he sees it reaching 665 million barrels.

Nuclear Issue Sets Off Surprise Blast

• Sharp debate enlivens Houston meeting of petroleum engineers over explosions in shale and tar sands.

A visiting scientist flushed some controversial birds last week when he spoke at the Houston meeting of the Society of Petroleum Engineers (AIME) on use of nuclear blasts for producing crude from oil shale and tar sands.

The speaker was Dr. Gerald A. Johnson, associate director of the Lawrence Radiation Laboratory at Livermore, Calif. He defended the "plowshare" program for peacetime uses of atomic energy.

After Johnson's talk, Dr. King Hubbert, chief consultant in geology for Shell Development and a member of the National Academy of Sciences, took the floor. He described the program as dangerous to humanity and called on his fellow oil men to "wake up."

Johnson, the principal speaker of the meeting, remained composed during the unexpected blast following his address. He conceded during his rebuttal that the question of fallout radiation is "controversial" and that scientists at Livermore "know it is dangerous."

"But we believe our course of action is the right course," he said. "We know a lot about these explosions and believe we can control them."

Following the meeting, Johnson said that a conference will be held late next month at Ottawa, Canada, to plan for a nuclear explosion in the Athabasca tar sands next year.

Attending the meeting will be representatives of Richfield Oil Corp, the Canadian Government, and Johnson as an observer.

Johnson said Richfield wants the test to be made by next February, but that administrative work required probably will cause a delay.

Four projects . . . At the SPE meeting, Johnson described four "plowshare" projects which Livermore scientists are currently studying.

One would blast a harbor on the Alaskan coast. Another would attempt to create power by blasting a salt formation. The other two would attempt to liquefy the hydrocarbons in tar sands and oil shale.

Johnson said the "plowshare" scientists do not know whether the tar sand and shale explosions would succeed in their purpose of finding a cheap way to produce crude from these vast untapped reserves. They are anxious to work on such projects if industry is willing to foot part of this bill.

In answer to a question from the floor, Johnson said scientists hoped that hydrocarbons released by a tar-sand blast would not be excessively radioactive. They reasoned that the detonation would be made below the sands, and isotopes "generally prefer to stay with the solids rather than go into the liquids."

He said there is "healthy skepticism" concerning possible success in oil-shale blasting.

"Shale is extremely tough," he said. "We know we can break it but don't know how big the pieces will be and whether they can be retorted. Not much is being done now on the project, but it is still hanging fire. We have agreed to go ahead if there is any interest. Our part is to make the explosive and make calculations on safety."

Experimental blasts in Nevada during the past 2 years, he said, have taught how to control the blasts.

Dangers cited . . . Hubbert took issue with Johnson on the issue of safety.

A blast in oil shale, which lacks porosity, might blow out the side of the mountain or vertically through the top and contaminate a wide area, he said.

Hubbert attacked the entire "plowshare" program and ridiculed its name as a "public relations type of war."

The oil scientist, who spoke as a member of the National Academy of Sciences and not as a Shell official, is a member of the academy's research council committee on disposal of atomic waste, an advisory group to the Atomic Energy Commission.

He described atomic waste as "the most dangerous toxic stuff ever produced by the human race," and said the problem of disposal is monumental because it remains dangerous in some cases for 100 years.

Hubbert criticized Dr. Edward Teller, father of the H-bomb and chief of the laboratory at Livermore, for making unproved claims about the value of nonmilitary nuclear explosions.

After the meeting, Hubbert told the Journal: "When you run this down, the only objective they have got is that they want to shoot bombs. If they can't shoot them in the air, they try to trump up excuses to shoot them somewhere else . . ."

The SPE meeting was attended by several hundred petroleum engineers. After Hubbert's talk, one of them, Jack Reynolds of Continental Oil Co. rose to state, "I think it only fair that Mr. Johnson know that a lot of us like to argue with Mr. Hubbert."

Shale-Oil Plant Is Proposed

. . . for Colorado by expert. He seeks $20-million backing for project he claims will turn out oil for $2 a barrel.

AN AUTHORITY on the mining of oil shale, Dr. Tell Ertl, is attempting to raise $20 million for construction of a 20,000-bbl.-daily shale-oil plant 20 miles north of Grand Valley in western Colorado.

He's convinced the plant could turn out shale oil for $2 a barrel.

This figure, he says, is based on data from experimental shale plants operated by Union Oil Co. of California and the U. S. Bureau of Mines. Union ran its pilot plant, 10 miles north of Grand Valley, in 1956, 1957, and 1958. The government plant, northwest of nearby Rifle, operated from 1947 until 1956. Ertl was engineering consultant for the Union operation. He was in charge of mining for the Rifle program.

Ertl says his firm, Energy Resources-Technology-Land, Inc., hopes to launch a commercial shale-oil industry with or without the help of the petroleum industry. The plan is for expenditure of $5 million to develop mines and $15 million for a battery of retorts comparable in size to the lone pilot plant Union used in its experiments. The engineer's company owns two 15,000-acre blocks of rich oil-shale land in southern Rio Blanco County. One block is estimated to contain 3 million barrels of re-

coverable oil locked in the shale.

Ertl says studies are being made to determine if it would be more feasible to build a new shale-oil refinery at the Grand Valley site or to pipe the raw product to existing crude-oil refineries.

Ertl says he's undaunted by the inevitable question: "How could I hope to be successful when the big oil companies are declining to jump into the shale-oil business?"

"Petroleum looks to me like another of the industries which, throughout history, have dragged their feet when something entirely new has turned up," the engineer replies.

Contracts Awarded

. . . by Midwestern for big gas line. Six contractors share in the work.

MIDWESTERN Gas Transmission Co. has awarded construction contracts on 348 miles of 30-in. pipeline and a 6,000-hp. compressor station for its newly approved gas line from Portland, Tenn., to Joliet, Ill., near Chicago.

Construction will start in July and should be completed this fall in time for the 1959-60 heating season.

The new line will take gas at Portland from the mainline of Tennessee Gas Transmission Co., parent company of Midwestern. It will deliver 360 million cubic feet of gas daily to the Chicago-Gary area under an application approved last month by the Federal Power Commission (OGJ, May 18, p. 162).

Following are the contractors and their jobs:

. . . **Grayco constructors,** 51 miles, from the TGT connection near Portland to a point near Cromwell, Ky.

. . . **Sharman, Allen,** Gay & Taylor, 43 miles, from near Cromwell to the Ohio river at the Kentucky-Indiana border.

. . . **Panama, Inc.,** 53 miles from the Ohio river to the White river near Algiers, Ind.

. . . **Majestic contractors,** 53 miles, from the White river to the Wabash river on the Indiana-Illinois line.

. . . **Bechtel Corp.,** 148 miles, from the Wabash river to near Joliet.

Additional contracts of approximately 2 miles will be let later for the Ohio, White, and Wabash river crossings.

The compressor station contract near Portland went to Houston Contracting Co.

watching WASHINGTON

Joe Reilly

• Congress gets little done, so far . . .

THE BIG DEBATE on Capitol Hill these days is whether or not the Eighty-sixth will turn out to be a "Won't Do Congress."

Sen. Thurston B. Morton of Kentucky, chairman of the Republican National Committee, has complained that Congress won't do what the President has recommended. And he has concluded rather hopefully that the Democratic-controlled Congress "just won't do."

In reply, Senate Majority Leader Lyndon Johnson of Texas has presented a long list of things he thinks Congress will do, now or later.

Outcome of the debate won't be known until next year's elections, and probably not then. But as far as the oil industry is concerned, it's becoming increasingly apparent that Congress won't do much this session.

Unlike Sen. Morton, the oil industry isn't too upset over this prospect. For much of the proposed oil legislation is punitive in nature.

So far this session, congressmen have introduced approximately 10,000 bills plus several hundred resolutions. Nearly any imaginable bill affects the petroleum industry in some manner, but there are only about 100 major bills which are being watched closely by the industry.

TINKERING WITH THE DEPLETION allowance is still one of the greatest threats to the industry this session. There are at least half a dozen depletion-cutting bills pending, but none of them is likely to get out of committee this year.

This may not prevent the issue from coming to a vote in the Senate, however. Anti-depletion senators haven't rounded up the votes they had hoped for, but they are keeping the issue alive. Any germane bill coming over from the House will give them a chance to test their strength.

A gain over the 31 votes they got last year on the Proxmire amendment would encourage further efforts later.

The imports question, once a major issue, has fizzled. At least 10 bills have been introduced to set quotas on oil imports. Two other bills would tax imported oil, and two would lift present import controls.

President Eisenhower took much of the sting out of the imports issue by imposing quotas early in the session. Sen. Joseph C. O'Mahoney (D-Wyo.) is still threatening to press his bill to limit imports by congressional, rather than presidential, action. He's created little interest.

Subcommittees in both houses have been studying bills to overhaul the Mineral Leasing Act. The Interior Department has opposed most major changes offered, and there is little likelihood of passage this year except perhaps for a watered-down version extending the primary lease term from 5 to 10 years.

STRONG OPPOSITION has bottled up several industry-harrassing bills. These include the perennial S. 11, by Sen. Estes Kefauver (D-Tenn.), which would limit the "good-faith" defense against price-discrimination charges. Also stalemated are O'Mahoney's bill to require advance notice of price increases by major companies in certain industries, and several anti-merger bills.

There is little danger, other than psychological, in the bill recently introduced to curtail dividends by oil pipelines to their shipper-owners. It is a face-saving bill, presented by Rep. Emanuel Celler (D-N.Y.) after a majority of his antitrust subcommittee and the Supreme Court both differed with him on how pipelines should be regulated.

Congress is expected to give its consent to renewal of the Interstate Oil Compact. The Justice Department likely will be required to continue its annual reports on the compact. In the past, the annual report has raised the question of divorcing pipelines from major companies.

The once-lively Natural Gas Bill, back in various forms this year, is now resting peacefully in the congressional limbo. It probably will be joined there by the gasoline-tax measure and other forgotten bills.

PHOTOS IN THE NEWS

Huge Crude Oil Pipe Still Now on Stream

The world's largest crude oil pipe still is now being operated by Standard Oil Co. (Ind.) at its Whiting, Ind., refinery. The new multi-million-dollar processing unit—with a capacity of 140,000 bbl.—replaces nine smaller, obsolete stills. The unit has a 173-ft. primary distillation tower and a 145-ft. high vacuum distillation tower.

Pipelines Carry the Mail

Highlighting the Oil Centennial at Titusville, Pa., was arrival of an 8-in. steel cylinder—containing microfilmed copies of letters from 33 governors.

The messages—attached to a pipeline scraper—had traveled 1,255 miles from Corsicana, Tex., through Magnolia, Buckeye, and National Transit pipelines.

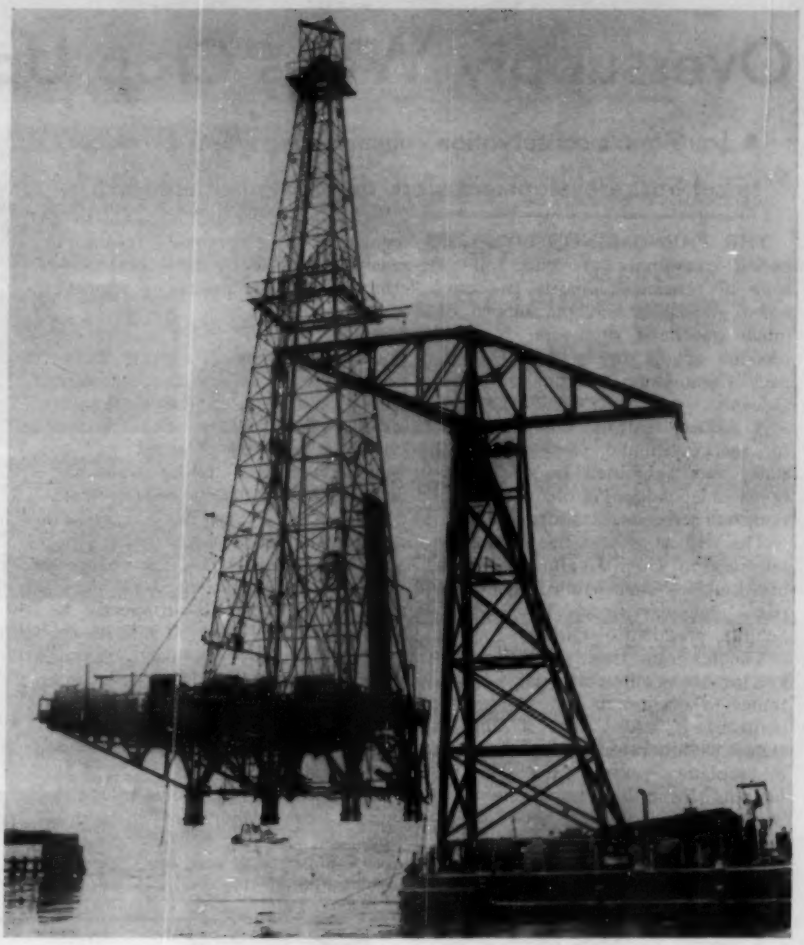
Shown removing the cylinder from the scraper are L. D. Sampson and P. R. Snow of National Transit.

Heave Ho!

Rig-moving time in Lake Maracaibo has been cut in half by moving the complete rig at one time.

The first pickup of a complete rig, weighing about 220 tons, is shown at the right. It's a Kerr-McGee Oil Industries, Inc., rig, which was moved from one location to another, rigged up and ready for drilling in 2 hours.

The method eliminates the necessity of separating the derrick from the substructure and moving the rig in two sections.



Gasoline Brand Changeover

Frontier Oil signs came down and new red, white, and blue signs of Ashland Oil Products went up on service stations in Buffalo and western New York handling Frontier Oil Refining Co. products.

It signaled a changeover in brand identification from Frontier to Ashland Oil in a marketing unification plan. In addition to the brand changeover, Ashland Oil & Refining Co., Frontier's parent company, introduced two new gasolines, one exceeding 100 octane.

Frontier Oil Refining, which operates exclusively in New York, will continue as a division of Ashland Oil & Refining.

Oversupply Woes Crop Up at IOCC

• Louisiana's conservation commissioner wants producers to cut back development work due to glut of crude.

THE PHENOMENON of an apparent oversupply of crude oil in spite of restricted imports and curtailed allowables was the subject of much unofficial discussion between sessions of the Interstate Oil Compact Commission meeting in New Orleans.

A request that the compact work for market-demand proration in all states was submitted by the Oklahoma Independent Petroleum Association, but it received no formal action.

The request was in the form of a telegram to Gov. J. Hugo Aronson of Montana, chairman of the Compact, and was signed by Paul R. Schultz, president of OIPA.

The telegram stated that the market for Mid-Continent crude oil continues to decline in spite of import controls. It added that it appears states without conservation laws or oil-regulatory bodies "are reaping the benefits" from any improvement in market demand brought about by import controls.

Schultz warned that failure of producers and state legislative bodies to regulate themselves may result in sweeping controls by the federal Government over the producing segment of the industry.

Louisiana problem . . . Much discussion also was given to the statement of Ashton J. Mouton, Louisiana conservation commissioner, at the recent state-wide allowable hearing.

Mouton pointed to the continuing decrease in nominations for Louisiana crude and said that the amount of crude available from new wells is increasing so greatly that the commission cannot cut the per-well allowables of older wells sufficiently to keep supply and demand in balance.

He laid much of the blame on producers because of their policy of drilling and completing development wells not required by lease or offset obligations and not needed to fill market demand.

He asked, in effect, for a moratorium on field development where possible, and said that the producing industry must share with the state conservation bodies the responsibility of avoiding an oversupply of crude oil.

Mouton said he will set the July allowable at a level maintained for almost a year. But he warned that the industry itself must do its part to retain the present 35% depth bracket figure. The Louisiana allowable is based on depth as well as acreage and producing potential.

Mouton noted suggestions that Louisiana reduce its allowable some 40,000 bbl. daily by cutting the depth-bracket formula. This might eliminate some immediate problems, he said, but at the rate of increase for new wells—some 8,000 to 10,000 bbl. daily per month—it would take only about 4 months to get back to the same production figure.

He added it would be ridiculous to continue to decrease the depth bracket to fit the slowly decreasing market demand because the allowables would become so low an operator couldn't drill and complete a well and pay out his investment over any reasonable period of time.

Mouton feels that the answer to the problem is not continually reducing the per-well or unit allowable, but in some manner limiting the amount of known reserves which are now available to the market.

PROCESSING BRIEFS . . .

A new highly automatic gas-products plant in McClain County, Oklahoma, to process 5 million cubic feet of gas and produce 32,000 gal. of liquid products daily, will be placed in operation about July 1 by Sunray Mid-Continent.

A multimillion dollar plant to process 50 million cubic feet of raw gas daily, produce 224 tons of sulfur, and recover 7,480 bbl. of liquid products daily, will be built by Tidewater in the New Hope-Smackover field in Northeast Texas. Four injection wells will be drilled to the 12,000-ft. Smackover. Residue gas will be reinjected to maintain reservoir pressures.

Shell Oil has been awarded a patent for gasoline compositions containing certain phosphorous compounds including those in Shell's TCP. The patent naming V. E. Yust and J. L. Bame, Wood River research laboratory, as inventors, has been assigned to Shell Chemical, owner of all Shell patents. The patent is directed to leaded gasoline containing certain proportions each of lead antidetonent halohydrocarbon scavenger and certain alkaryl phosphates and phosphites. Shell introduced the additive into motor gasoline in 1953. Today it is estimated 65% of all premium and 12% of all regular sold in the U. S. contains phosphorous.

A gas products plant, to recover 48,000 gal. of liquids daily, will be built in the Maljamar and Loco Hills fields of Eddy County, New Mexico, by Skelly Oil Co. and Sinclair Oil & Gas Co. The plant, which will be ready for operation in April, 1960, is designed to process 20 million cubic feet of gas daily.

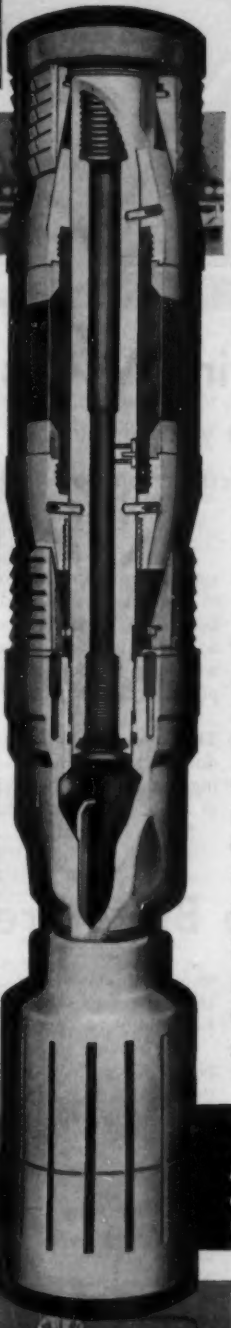
ASTM has recommended adopting the rad as a national standard unit for reporting radiation exposure or dosage. Representing 100 ergs of energy absorbed per gram of material, the rad is more generally applied than other units. The well-known Roentgen unit for example applies only to X-ray and gamma ray absorption by air and must be modified to an equivalent unit called the rep.

Also for Refiners . . .

IN THE NEWS: Toll road service centers are proving tricky as money makers for oil marketers. Trend now is against profitable operation (68) . . . Report says refining centers in U. S. Upper Midwest and Puget Sound area are best markets for Canadian crude (p. 71) . . . Shale-oil expert seeks $20-million backing for Colorado plant (p. 72) . . . Western Natural Gas, affiliate of El Paso Natural, has bought Premier Oil Refining (p. 78) . . . Sohio unveils its simple, shortcut process to acrylonitrile (p. 80) . . . Authorities vote to order olefin content of gasoline cut in Los Angeles (p. 83).

PLUS THESE TECHNICAL REPORTS: Sulfide scaling under hydrorefining conditions (p. 102) . . . Air cooling in petrochemical plants (p. 128).

DEPENDABLE *BAKER* SERVICE



DEPENDABLE *BAKER* CEMENT RETAINER

PRODUCT NO. 400

There is nothing "just as good" as a Baker Cement Retainer for placing cement, plastic, acid or other fluids through tubing or drill pipe—at the most effective point behind casing or liner—around the shoe, or in open hole below the shoe. Dependable pack-off, known drillability, and the presence of a back-pressure valve which automatically holds squeeze pressure against the formation, bring peace of mind on all squeeze jobs.

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Baker CEMENT RETAINER SERVICE is available anywhere, anytime. Just call the Baker Trained Serviceman in your area.

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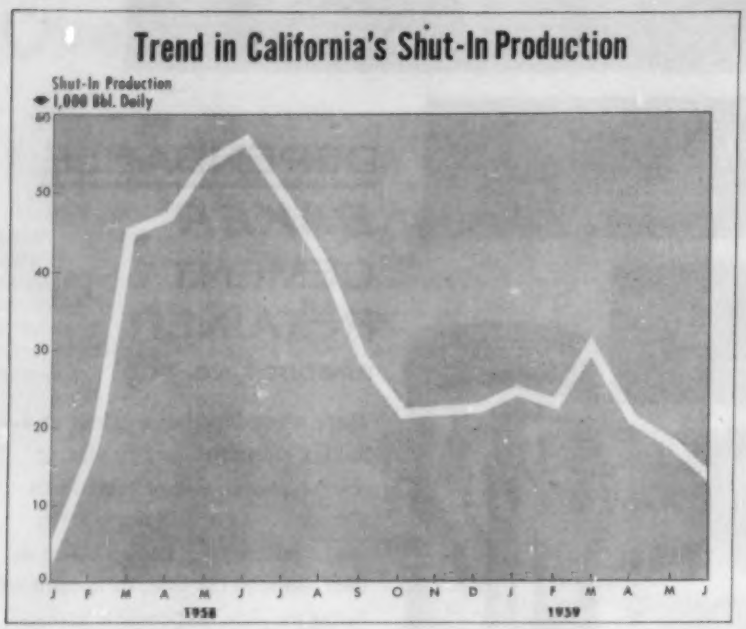


California Reviving Wells

. . . which were shut in last year because of oversupply of heavy fuel oil. Shut-in production now is 12,000 bbl.

CALIFORNIA producers have reopened most of the low-gravity oil wells shut in a year ago in an effort to keep heavy fuel-oil inventories from becoming too top heavy.

The revived production brightens the outlook for heavy crudes—but there are still some gloomy spots. Higher imports during the second half, plus increased drilling in low-gravity fields, may again create an oversupply situation. There also will be a further drop in demand if the presently curtailed Los Angeles fuel-oil market undergoes another decrease.

Working to offset these factors are stepped up shipments of residual fuel to the East Coast and foreign markets. Also, new catalytic cracking and coking equipment under construction will remove some of the surplus supply of residuals.

The trend . . . The amount of oil production shut in increased steadily during the first half of 1958. It peaked at about 57,000 bbl. during last June.

Since June of '58 the trend has reversed. By last October the amount had dropped to around 21,000 bbl. Since then wells have been revived more slowly and at the end of May an estimated 12,000 bbl. of low-gravity crude was still shut in. This is, of course, exclusive of the 130,000 bbl. of shut-in production at the Elk Hills Naval petroleum reserve.

Of the current shut-in production, most is on fee-owned lands of General Petroleum Corp. and Union Oil Co., and on Long Beach city properties in the Wilmington field. Union plans to restore most of the inactive wells during the next month, reducing the shut-in total by another 4,500 bbl. daily.

Top-heavy inventories of residual fuels which developed last year now have been largely worked off. Current stocks are estimated to be about 7,000,000 bbl. below the 33,000,000-bbl. level of a year ago. Residual cracking stocks are about half the 10,000,000-bbl. total they were a year ago.

Drilling increases . . . Though imports of foreign crude oil and domestic natural gas were primarily blamed, the excess condition was partially brought about by over drilling. Operators in 1957 completed 1,053 low-gravity (below 20°) wells, several hundred more than in any other postwar year except 1948.

Last year they eased off, completing only 508 low-gravity wells, but drilling is again trending upward. Overall drilling in California during the first 5 months has been at a slower pace than in 1958, but a higher percentage of low-gravity wells are being completed. Based on the 5-month record, some 100 more heavy-oil producers may be completed this year than were in 1958. Most of the revived drilling activity has been in San Joaquin Valley fields.

El Paso Affiliate Buys Premier Oil Refining

WESTERN NATURAL Gas Co., an affiliate of El Paso Natural Gas Co., has become a fully integrated company with the $8,850,000 purchase of three small refineries, 750 miles of pipeline, and 700 service stations.

Western Natural bought Premier Oil Refining Co., a division of City Products Corp., Chicago.

Premier, with headquarters at Longview, Tex., has refineries at Longview (5,000 bbl. capacity), Fort Worth (8,000 bbl.), and Baird (2,500 bbl.).

Three pipelines and gathering lines transport crude for the refineries from the East Texas field and other fields in west central Texas.

The service stations are located in North Texas, from Red River through the Dallas-Fort Worth area, and along U. S. 80 to Shreveport, La. The "Premier" brand name will be retained.

Rebuilding plant . . . Premier has an import quota of 1,550 bbl. daily which will be available for Western Natural's Venezuelan production.

Paul Kayser, president of Western Natural, said the purchase of Premier "will mark a new era of progress for Western Natural, in that upon the consumation of the purchase, Western will become an integrated oil company, owning production, refining, and distribution properties."

In January, Western Natural bought the McBride Oil & Gas Corp. refinery near Brownsville and is now rebuilding it to produce road asphalt. It will have a daily capacity of 5,000 to 6,000 bbl.

The company also owns jointly with Continental Oil Co. three natural gas plants in Hidalgo, Victoria, and Aransas counties, Texas.

Socony Licks Cat Reformer Vapor-Inlet Problem

• New method distributes vapors over reformer cat bed to prevent shifting and plugging. It also aids flow through reactor.

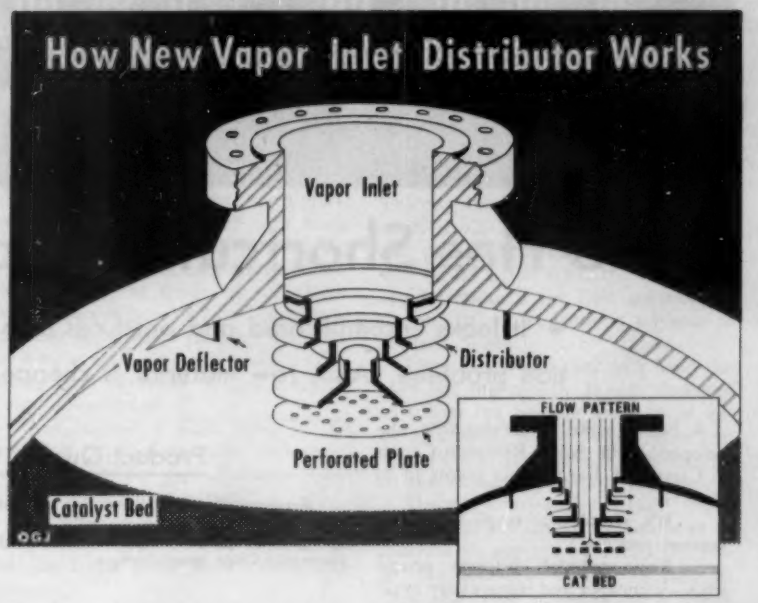
A NEW vapor inlet distributor for fixed-bed reforming units has been designed by the research and engineering department of Socony Mobil Oil Co.

The device spreads the down-flowing vapor feed evenly over the entire catalyst surface, avoiding high velocity impingement at the center of the bed. This improves the reforming operation three ways:

... **By reducing turbulence** at the center of the bed, the distributor prevents movement of catalyst toward the reactor rim. This avoids vapor channeling through uneven bed depths.

... **Undisturbed catalyst** produces less fines which tend to plug the bed surface and result in higher pressure drop through the reactor.

... **Proper vapor distribution** over the catalyst surface does away with the need for additional free space above the bed.



The distributor discharges about 60% of the inlet vapors from the top two rings. These streams are further slowed by deflectors. The vapors pass through the lower rings at reduced velocity and can be discharged directly into the reactor without impinging against a deflector.

The bottom plate in the distributor is perforated to pass about 10% of the inlet vapors. The small stream which passes directly through this plate counterbalances any inward flow of vapors along the catalyst bed.

The company is using this distributor effectively in several units where a short distance separates the inlet nozzle and the catalyst surface.

Land Fraud Victims Protected

. . . under O'Mahoney bill changing Mineral Leasing Act.

Proposal affects 281,000 acres facing lease cancellation.

SEN. Joseph C. O'Mahoney (D-Wyo.) has introduced a bill to liberalize and clarify the Mineral Leasing Act.

One of the chief provisions of the bill is to protect innocent lease assignees from cancellation proceedings alleging fraud or other violations of the law by original leaseholders.

The Bureau of Land Management is now seeking cancellation of federal oil and gas leases covering some 281,000 acres in Wyoming and Montana. Leases involved were alleged to have been "fraudulently" acquired in violation of the acreage limit or other provisions of the Mineral Leasing Act.

O'Mahoney's bill would give a party to such action the right to have the proceedings dismissed upon showing that he acquired his interest in good faith without violation of the law. But it would authorize the Secretary of the Interior to request federal court proceedings by the Attorney General in cases believed to have involved fraud. Persons found guilty of fraud in such cases could be barred, either permanently or temporarily, from holding any lease or other interest in land under the leasing act.

Any person found not guilty in the lease-cancellation proceedings would be allowed an extension of his interest for a period of time equal to that in which development rights were suspended.

Acreage limits . . . The Senate bill also would set a limit of 246,080 acres on federal options and leases which a company or individual may hold in any single state other than Alaska and the Hawaiian Islands.

Under present law a company or individual may hold only 46,080 acres under federal lease in any state except Alaska. Under the proposed amendment, the combined lease-option limit could be held in leases alone.

Florida Leases Granted

THE FEDERAL Bureau of Land Management has awarded leases on 132,480 acres in offshore Florida to the only two companies that offered bids, Gulf Oil Corp. and The California Co.

Gulf and Calco had not decided last week which one will operate the 22 tracts on which they bid jointly. Calco was sole bidder on another tract.

Gulf currently has a tight hole drilling west of Key West, which is east of the lease area.

Bids totaled $1,711,872, an average of $12.92 per acre. (OGJ, June 1, p. 102).

$$CH_2=CH-CH_3 + NH_3 + \tfrac{3}{2}O_2 \xrightarrow{CAT} CH_2=CH-CN + 3H_2O$$

(PROPYLENE) + (AMMONIA) + (Air) ⟶ (ACRYLONITRILE) + (WATER)

Sohio Has Shortcut to Acrylonitrile

• It looks uncomplicated and produces high-purity product without separation problems. Also, raw material is cheaper and easily available.

A NEW route to acrylonitrile, developed in the Sohio Research Center in Cleveland, has two big points in its favor:

... **It's simple**—a single-step conversion process.

... **Raw material**—refinery propylene—is cheaper and more easily available than those formerly used.

Acrylonitrile is an important intermediate for synthetic fibers and has many other uses besides. Earlier processes, according to Standard Oil Co. (Ohio), required more costly raw material, such as hydrogen cyanide, ethylene oxide, or acetylene, and also were more complicated.

Sohio Chemical Co., wholly owned subsidiary of Ohio Standard, already is building the first commercial plant to use the new process. Location is at Lima, Ohio. The plant is scheduled to go on stream early in 1960.

The process . . . Basically, the Sohio process is a catalytic vapor-phase, one-step reaction.

The operation is conducted at moderate temperatures (below 900° F.) and low pressure (less than 3 atms.) with residence time of only a few seconds.

It is highly selective, giving good yields of acrylonitrile and commercially recoverable amounts of valuable byproducts—acetonitrile and hydrogen cyanide.

The principal raw materials required are refinery propylene streams and fertilizer-grade anhydrous ammonia. The necessary propylene concentration is not critical (40 to 90% being quite acceptable). Substantial amounts of low molecular weight hydrocarbons can be tolerated in the feed stream. In some cases, economics may warrant a preconcentration of the propylene, but this is not dictated by process requirements.

The catalyst is used as a fluidized bed. The special catalyst is durable chemically, physically, and thermally. It depends for its activity on a high concentration of active ingredients rather than a trace constituent.

This means the catalyst is not readily affected with trace contaminants. However, desulfurized hydrocarbon feed should be used to prevent a bulk sulfate laydown on the catalyst.

Actual process chemistry is very simple (see equation above). The minor amounts of byproduct acetonitrile and hydrogen cyanide obtained possibly originate by oxidative attack on the propylene molecule at the double bond rather than at the methyl group.

Other interesting aspects of the process:

... **Selectivity** is primarily due to nature of catalysts and the process conditions.

Researchers found many catalysts will give trace quantities of acrylonitrile from this reaction. But extensive tests were necessary to select conditions that achieve high activity and selectivity with the Sohio acrylonitrile catalysts.

... **Oxygen and ammonia** are used only in average quantities.

And as far as reaction requirements are concerned, it's unimportant whether oxygen or air is employed.

Product Quality Using Sohio Process

Acrylonitrile produced by larger pilot-plant equipment with the Sohio process has been of unusually high quality. This is evident in comparing the analysis of plant effluent with specifications laid down for product used in synthetic fiber manufacture.

	Sohio Product	Required Specifications
Appearance	Clear	Clear
Color, APHA	less than 5	5 max.
Distillation range, °C.	75.0-77.2	74.5-78.5
Inhibitor, p.p.m.	45	35-45
Nonvolatile matter, p.p.m.	10	100 max.
Oxygen bomb stability, hours	4 plus	4
pH	6.6	6.0-9.0
Refractive index n_D	1.3888	1.3882-1.3891
Titration value, ml.	0.5	0-2.0
Specific gravity	0.7996	0.7990-0.8020
Impurities: p.p.m.		
Acetone	50	300 max.
Acetonitrile	350	500 max.
Acrolein	10	5 max.
Acidity	15	20 max.
Aldehydes	15	50 max.
Copper	0.02	0.10 max.
HCN	2	5 max.
Iron	0.05	0.10 max.
Water, wt. %	0.35	0.25-0.45
Cyanobutadiene	none	none
Divinyl acetylene	none	none
Methyl vinyl ketone	none	none
Peroxides	none	0.2 max.

Air, of course, is less costly. It probably is favored because the diluent nitrogen resulting does not enlarge the reactor sufficiently to warrant a separate oxygen plant.

... **CO and CO_2** both are produced in significant amounts.

They represent the major nonproductive use of propylene. Propane and the lower hydrocarbons, including ethylene, are inert under the reaction conditions. Butylene and higher hydrocarbons tend to react under processing and give complex product mixtures. Consequently, they are avoided in the feed streams, although trace quantities may be tolerated.

Actually, the simplicity of the direct process is more apparent when it's contrasted with other possible routes to acrylonitrile using propylene as the major raw material. These involve initial oxidation of propylene to acrolein, then processing this to derive acrylonitrile oxidatively from acrolein and ammonia.

The product . . . The acrylonitrile product obtained usually is pure and free of such troublesome materials as vinyl ketone, divinyl acetylene, and cyanobutadiene.

The product is fiber grade and has met major U.S. consumer specification trials. Pilot-plant quantities of the product have been polymerized, spun, dyed, and aged without difficulty.

Product recovery is one of the favorable features of the Sohio process. And the recovery and purification steps in the Sohio route are comparatively simple.

The reactor effluent is treated to separate fixed gas and unreacted hydrocarbons. The unreacted hydrocarbons pass to a stack or to recovery equipment as values dictate. The acrylonitrile is finished by drying and final distillation. By-product acetonitrile is converted to high purity product also by drying and final distillation. A high concentration HCN stream may be available for commercial processing if desired.

The product-recovery steps have been extensively checked with cooperation of Badger Manufacturing Co. Tests were made in continuous laboratory equipment made up of Oldershaw column units of 1 or 2-in. diameter and appropriate platage. The Oldershaw construction resembles a miniature glass sieve-tray design, complete with downcomers.

Correlations of work done in this type of equipment with industrial-scale operation generally have been excellent in skilled hands.

Commercial plant . . . Detailed design of the Lima plant shows these features:

... **Low electrical load** needed.

... **Small fresh water** requirement.

... **Self-sufficient in steam** requirements.

... **No unusual water effluent** to pose pollution problems.

The site selection thus was based entirely on raw material availability and economics of product transportation.

In preparation for large-scale production, the special catalyst has already been prepared in large amounts in commercial-size equipment.

Import Quota Hiked

. . . but court must act on Eastern States' increase.

EASTERN STATES Petroleum & Chemical Corp. has won a point, at least temporarily, in a battle to increase its import quota.

A federal judge in Houston granted Eastern States the right to import an extra 1,420,720 bbl. of crude with the provision that this amount later will be deducted from the company's regular quota if the final decision on the merits of the case is adverse to Eastern States.

Judge Joe Ingraham will hear the case late this month. It was docketed to follow the hearing June 24 of another case in which Texas American Asphalt Co. is attacking the validity of the mandatory import program.

The temporary order in the Eastern States case authorizes the company to increase its imports by 1,420,720 bbl. for the period of March 11 through June 30. This amounts to a quota boost of about 12,800 bbl. daily.

A spokesman for the company said no comment could be made at this time on whether Eastern States will challenge the entire program.

However, the company plans to appeal its new quota, established for the July 1-December 31 period. The new quota is for 11,810 bbl. daily, down 670 bbl. from the old quota. The appeal will go to the appeals board in Washington, which already has denied the company's petition for a higher quota for the earlier period.

the JOURNAL *said* . . . . . .

50 *years ago*

June 20, 1909

St. Louis interests, headed by Adolphus Busch, brewery magnate, pay $7,480,000 for the majority ownership of Laclede Gas Light Co., operator of St. Louis' only gas plant, and announce plans for a 550-mile gas pipeline from Caddo field, in northwestern Louisiana.

Sixty-eight tons of coal were burned as fuel in making the last 48 ft. of hole in Livingston Oil Co.'s first test, drilled by Sid Keoughan, contractor, near Livingston, Mont. The wildcat was dry at 1,150 ft. but had oil showings in an 800-ft. formation, to which the company's second test will be drilled.

Charles T. Madison, formerly general manager of Muskogee Refining Co., at Muskogee, Okla., completes arrangements for building a refinery at Fort Smith, Ark. It will run on crude from Muskogee field hauled in tank cars by Midland Valley Railroad.

25 *years ago*

June 21, 1934

Injunction suits in U. S. District Court at Austin claim 600,000 M.c.f. of natural gas is being wasted daily by owners of gasoline plants and producers in the Texas Panhandle.

Barnsdall companies, including Barnsdall Refineries, Inc., Barnsdall Oil Co. of California, and others, merge into centralized unit under name of Barnsdall Oil Co., with E. B. Reeser as president.

Famous large Barco concession of Colombia, S. A., gets first commercial producer, drilled by Colombian Petroleum Co. (Gulf) and completed as 2,500-bbl., 42°-43°-gravity oil well at depth of 790 ft.

HEADLINES: National recovery review board recommends federal control of overproduction. . . . Stripper operators in Wichita Falls and Ranger districts of North Texas turning to repressuring to increase oil recoveries. . . .

10 *years ago*

June 23, 1949

Gas flares from more than 275 wells in the LaGloria and Blucher fields of Jim Wells and Brooks counties, South Texas, have been put out as LaGloria Corp.'s new 7,200-hp. compressor unit goes into operation at company's cycling plant. Some flares had been burning since 1939.

Shell Oil Co. becomes first to file for geophysical exploration in the Gulf of Mexico off the Texas coast under the new state law permitting exploration prior to leasing. Formerly, no exploration could be carried on before obtaining leases.

HEADLINES: Rocky Mountain operators not unduly concerned by current lull in activity after record-smashing year (1948). . . . Petroleos Mexicano may get $100,000,000 U. S. loan for oil production and refining facilities. . . . Ohio Fuel Gas Co., Columbus, to expand underground natural gas storage capacity 16.1 billion cubic feet at cost of $1,090,075.

Texas Goes to 9 Days

. . . for July allowable due to high inventories of crude. New schedule is 237,643 bbl. below June figure.

CONFRONTED with overflowing crude storage, the Texas Railroad Commission last week chopped the state's crude-oil allowable for July by nearly 240,000 bbl. a day.

The agency adopted a 9-day producing pattern, the lowest since July last year.

The initial allowable next month will be 2,666,771 bbl. daily. This is 237,643 bbl. daily below the initial allowable for June and 209,880 bbl. daily below the figure in effect June 6. The June 6 figure was well below June 1 due to a 50,000-bbl. cut by the commission to pare off unused allowable.

Stock troubles . . . The commission acted after several major crude buyers testified their stocks would be excessive unless a severe allowable cut was made.

Gulf Oil Corp. testified that its stocks as of June 1 were 1,500,000 bbl. excessive. The company, according to buyer Jack Coates, had reduced refinery throughput 72,000 bbl. daily below planned runs for June and will reduce planned runs for July 100,000 bbl. daily.

At current operating levels, Gulf is charging 15 to 16% less crude than in May due to what it calls "greatly excessive products stocks, Gulf-wise and nationally."

Coates said Gulf has shut down a 30,000-bbl.-daily unit at one of its refineries. And at its big Port Arthur works it will soon be shutting down for June and July a 130,000-bbl.-daily unit which it had planned to shut down in August.

Coates said that on 9 days allowable Gulf will send oil to storage at a rate in both June and July of 52,000 bbl. a day unless it is able to sell some crude. This would mean crude storage of more than 4,500,000 bbl. above normal level as of August 1. Gulf said it had been unable to sell a barrel of oil of any kind in May or June.

Gulf was one of five major buyers seeking the 9-day pattern. Others were Magnolia, Indiana Oil Purchasing, Atlantic Refining, and Cities Service.

On the high side with 11-day nominations were Humble and Sun. Humble said its demand for July will run considerably higher than in June. The company already has committed itself to spot purchase 36,100 bbl. daily and has made arrangements to buy another 6,000 bbl. daily of distress crude in North Texas. Humble said, however, it would need an 11-day schedule from its own connections to meet its current needs despite the spot purchases.

Falling between the high and low demands came Texaco, Phillips, Sinclair, Shell, Conoco, and Standard of Texas with 10 days.

Most of these firms appeared agreeable to a 9-day schedule.

Independents . . . Testimony from independents was unusually light. Those who did appear sought low allowable for July.

W. A. Moncrief, representing himself and Champlin Oil & Refining Co., sought 9 days. He said he feels the situation is so critical that independents are facing widespread pipeline proration if oil production is not sliced heavily.

Olen Culberson, member of the commission, called attention to stocks figures showing actual stocks of crude and products nationally at 648,510,000 bbl. This compares with a combined total of 589,500,000 bbl. figured as the desirable level by company spokesmen testifying at the March allowable hearing. Culberson pointed out, however, that stocks of crude nationally were only 6,000,000 bbl. above desired levels—that the great bulk of the depressing stock surplus is in gasoline and other products over which "we have no control."

U. S. Threatens

. . . to shut in Wilmington as repressurizing lags.

THE THREAT of a court-ordered shutdown of all production again faced operators in California's largest oil field, the Wilmington field in the Los Angeles basin.

The government re-activated a suit which calls for such a move if operators fail to keep a previously-agreed schedule of voluntary repressurization. The suit, which had been off the calendar since last March, was reopened with the charge by government attorneys that operators were falling far behind the schedule.

U. S. Attorney Laughlin E. Waters told a Federal Court in Los Angeles that efforts by operators at this time was "markedly less than anticipated." Federal Judge Harry C. Westover ordered the 121 active operators and 274 former operators at Wilmington to come up with an explanation for the slowdown August 3.

The latest move marks a sharp reverse in the attitude of the Government regarding the voluntary repressurization program. Last March, when the Government asked that the suit be set aside, Wilmington operators were praised for their efforts. At that time, the records show that about 200,000 bbl. of water was being injected daily.

According to the schedule, however, by this time, the rate should be right at 400,000 bbl. daily. The current rate is only about 210,000 bbl. daily. Waters says this indicates virtually no progress in the last 3 months.

The voluntary plan calls for 1,113,500 bbl. of water being injected daily in 238 wells by 1961. The flood is primarily designed to halt the disastrous land subsidence in the field which threatens to wreck the huge Long Beach Naval Base as well as private industrial plants. Engineers variously estimate that the flood probably will result in an additional crude recovery of between 400 and 600 million barrels.

PIPELINE

A firm sale from underground storage of 30,000 M.c.f. daily is planned by Northern Natural from the newly developed St. Peter-Elgin storage project near Redfield, Iowa. The expansion, pending before FPC, will raise Northern capacity to 1,272,000 M.c.f. daily. It will include 8 miles of 30-in. mainline loop north of Ventura, Iowa, 22 miles of branch lines, and a 2,000-hp. compressor addition at Sunray, Tex. The project will cost $2 million.

Construction will be completed July 1 on a 47.5-mile 6-in. natural-gas liquids line from Windfall field in Alberta to Edson. Fulton Banister, Ltd., is building the line under contract for Hudson's Bay Oil & Gas.

Contracts have been let by Southern Natural on 290 miles of construction, pending approval of the FPC. Contractors are C. S. Lenoir Construction Co. and Oklahoma Contracting Co.,

Stiffer Smog Rules Adopted

. . . for Los Angeles area. Compulsory changes in motor fuels may mean $50-million refinery alteration program.

THE LOS ANGELES Board of Supervisors has adopted a severe rule which will limit the olefin content of motor fuels sold in the metropolitan area.

The rule was recommended by the Los Angeles Air Pollution Control District as an antismog measure.

Oil men generally believe the step will not solve the smog problem and will be extremely expensive to refiners.

Industry spokesmen, while not opposing the adoption of the rule last week, had testified at previous hearings that such a move would not help the Los Angeles smog situation. Adoption of the rule means the first cut in the olefin content of gasolines sold in the Los Angeles region will come in about 1 year.

The ordinance provides that any motor fuel marketed after June 30, 1960, must have a bromine number of 30 or less (equivalent to 18% olefin content). By the end of 1961 the limit will further be lowered to 20 bromine number or 12.5% olefin content. According to the APCD, a typical Los Angeles motor fuel now contains about 23% olefins.

Industry spokesmen estimated for the APCD that meeting provisions of the rule will require an investment of about 50 million in catalytic-reforming and hydrogenation facilities and that 2 years will be needed for their construction. Cost of the gasoline to the motorist would increase about eight-tenths of a cent per gallon.

An amendment tacked on the new regulations at the last minute provides that the bromine number restriction can be changed prior to June 30, 1960, if studies indicate such a move would be helpful to lessening the smog problem. However, full hearings would be held before any proposed changes were made.

The olefin picture . . . The APCD's monthly survey of gasolines sold in Los Angeles gives an idea of the extent olefins will have to be reduced under the program.

Of the 49 regular and premium gasolines tested during May, only eight had a bromine number of less than 20.

Sixteen had numbers between 20 and 30; eighteen were between 30 and 40, and seven had a bromine number above 40. Six of the latter, all premium-grade products of small refiners, had numbers ranging between 49 and 55.

The seven major marketers sold premium-grade gasolines that averaged 30.4 bromine number. The range was from 18 to 39.6. Their regular-grade gasolines ranged from 17.3 to 34.3 and averaged 26.6.

None of the seven had regular or premium-grade gasolines that would both meet the 30 bromine number limit set a year from now. Either their regular or premium was too high. There was one exception, but this company's middle-grade gasoline was well above the limit.

State situation . . . The move toward motor fuels of lower olefin content could spread throughout California.

A bill placing severe restrictions on the composition of motor fuels has been introduced in the California assembly. However, the bill has been referred to an interim committee, so no legislative action is expected before the 1961 session.

The bill would require:

. . . Olefin content be reduced to zero within 1 year.

. . . The TEL limited to 3 cc. per gallon to start with and then cut at the rate of 0.3 cc. per month until it was zero.

. . . A sulfur content of 0.05%—about half that contained in current premiums.

. . . Metallic additives could not be used.

BRIEFS . . .

45 miles of 24-in. from Gwinville field to Macon, Ga.; C. S. Lenoir & Harbert Construction Corp., 66 miles of 20-in. between Gwinville and Macon; Buchanan Pipeline Co., Inc., 79 miles of 16-in. from Macon to Wrens, Ga.; Harbert Construction, 22 miles of 14-in. between Griffin and Atlanta; and Oklahoma Contracting, 79 miles of 18-in. between Cranville field and Gwinville. The projects are to be completed by November 1. The 290-mile program is part of a 590-mile expansion approved by an FPC examiner last week.

Texas Eastern has completed and placed in operation its $2,000,000 products line from Tyler to Carthage, Tex. The 62-mile 8-in. line connects LaGloria Oil & Gas Co.'s Tyler refinery with Texas Eastern's Triangle products system. LaGloria is a Texas Eastern subsidiary. A new lateral from Carthage to El Dorado, Ark., connects at El Dorado with Texas Eastern's Little Big Inch products trunk from Beaumont to Chicago and Lebanon, Ohio.

A construction program of 81 miles of 10 to 24-in. trunk lines will be completed by Lone Star Gas late this summer. The projects include 36 miles of 20-in. from Navarro County to Dallas, 12.4 miles of 20-in. from Parker County to Fort Worth, and 4.7 miles of 24-in. in Dallas County. Company crews are handling all construction.

Three compressor-station installations are being made by Kansas-Nebraska Natural in Kansas. Contracts have been let to Shade & Sons to install 1,800 hp. at Quinter, 950 hp. at Holcomb, and 950 hp. at Palco, to be completed in October.

Two stations are under construction on Texas-New Mexico Pipe Line's crude system. Station Construction Co. is installing a 2,200-hp. station at Placitas, N. M., and a 1,100-hp. station at Shiprock, N. M.

Also for Pipeliners . . .

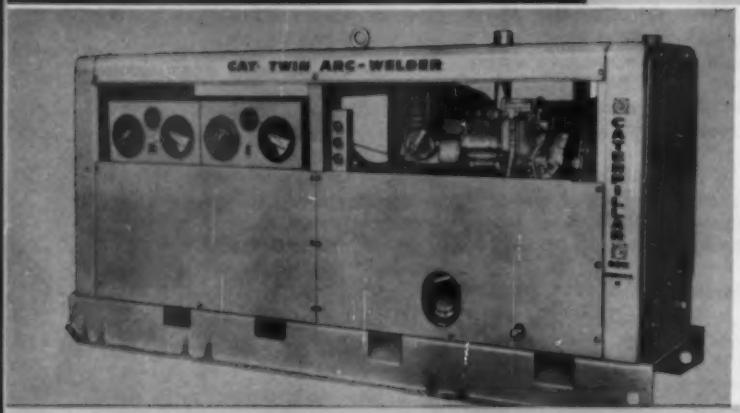
IN THE NEWS: Midwestern Gas Transmission lets contracts for its 348-mile 30-in. project (p. 73) . . . Western Natural Gas, affiliate of El Paso Natural, becomes fully integrated with purchase of Premier Oil Refining (p. 78).

A complete list of pipeline construction contracts is carried in the last issue of each month. Current projects are carried in pipeline briefs.

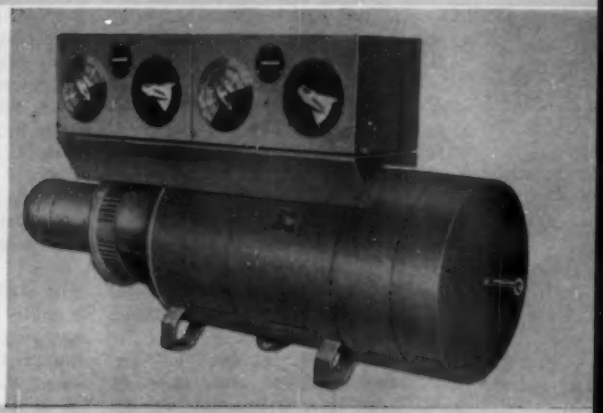
PLUS THIS TECHNICAL REPORT: Spheroids separate batches in products pipeline, Part 2 of two-part series (p. 116).

engine power
BY CATERPILLAR

A new twin arc-welder that costs less, weighs less, takes up less space



Powered by the Cat D311 (Series H) Engine the new, compact Twin Arc-Welder has ample power and capacity to handle two 300-amp. arcs. It costs less and has faster recovery. Operators know it has hot arc on contact with no waiting for the machine to come up to speed. Operation is smoothly uniform and control is completely automatic.



Reliable Cat power drives twin Lincoln welding generators and features two independent control panels permitting different welding operations at the same time. The single unit, two-arc package is only 35 inches wide to permit placing two side by side on the average truck bed—enough power to supply four men.

By powering this new electric arc welder with a D311 (Series H) Engine, Caterpillar has improved on the performance of the D315 powered welder. It's 1,300 pounds lighter, 20 inches shorter, 3½ inches lower and 4½ inches narrower—a lighter, more compact, more transportable unit that can meet the most exacting pipeline schedules and the toughest terrain. Big news, too, is its lower purchase price.

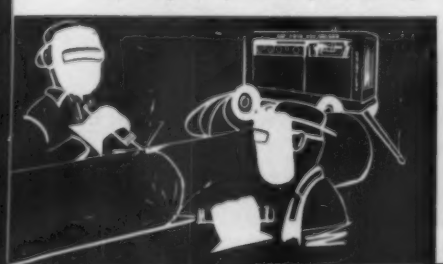
The new Cat Twin Arc-Welder combines two welding generators in one frame with dependable Caterpillar 4-cycle power. Dimensions above are for the skid base arrangement with base type fuel tank. Also available is four-wheel, heavy-duty running gear with springs and parking brake.

THESE FEATURES MEAN PROFITABLE WELDING FOR YOU:

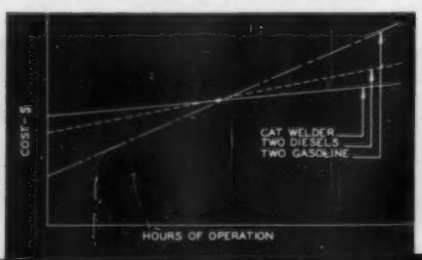
1. Simultaneous operation of two arcs with the two 300-amp. Lincoln welding generators powered by the Cat D311.
2. Independent generator controls allow welding at different voltages and amperages or polarity at the same time.
3. 600 amp. for automatic welding available by a simple connection change.
4. The Cat D311 Diesel can use a wide range of readily available fuels including low-cost grades.
5. Ample power for four welders (two Twin Arc-Welders) easily transported on one small truck.
6. Large capacity 3 KW exciter provides extra power for auxiliary tools.

Engine Division, Caterpillar Tractor Co., Peoria, Ill., U.S.A. Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

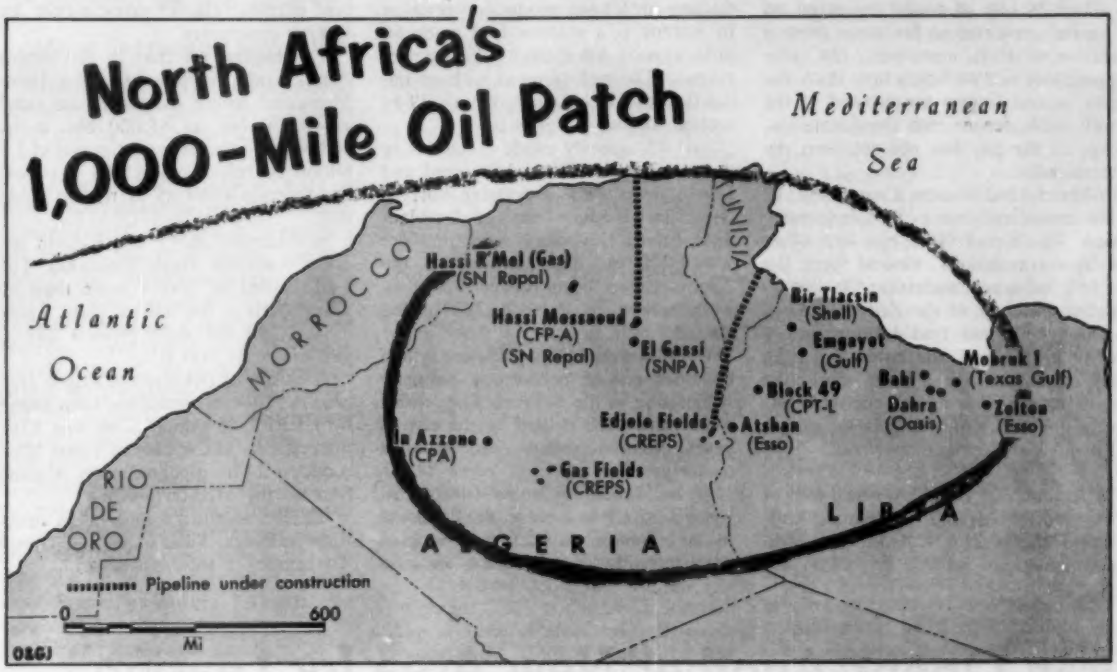
NO FREEZING even when two rods work at capacity. Cat Diesels have the "lugability" to keep current up.



LOWER OPERATING INVESTMENT over life of a welding unit is important. A Twin Arc-Welder saves money over other makes.



CAT PARTS AVAILABILITY is in line with superior dealer service. More than 400 domestic Cat parts stores.



Libyan Finds Keep Oil Province Hot

- Esso's 17,500-bbl.-daily wildcat is front runner for top find of year, adding luster to an area in North Africa already being compared with the Mid-Continent in the U.S.

A REMOTE Libyan wildcat completed as a 17,500-bbl.-daily producer could be the discovery of the year.

The well is Esso Standard's Zelten 1, located 100 miles from the Mediterranean Coast and 200 miles south of Bengasi in eastern Libya. The discovery opens a new area of Cyrenaica for further exploration and development. It also is a major well on the eastern end of a young oil province that stretches for more than 1,000 miles across arid North Africa.

The Esso success was followed last week by a discovery by another operator in Libya. Texas Gulf Producing Co. recovered 28 bbl. of 40°-gravity oil on a 1-hour drill-stem test from 3,100 ft. in Mobruk 1. The well is on Concession 17 south of the Gulf of Sirte.

In Algeria the major finds of oil at Hassi Messaoud and gas at Hassi R'Mel lie on the western end of this oil patch, which geologists are comparing with the U. S. Mid-Continent. A new find at In Assene, also in bustling Algeria, has extended the 3-year-old oil country still farther westward.

Esso success . . . Zelten 1 produced 37°-gravity crude at the rate of 17,500 bbl. daily on a 12-hour production test. Flow came from a 205-ft. section of Paleocene limestone from 5,460-5,665 ft.

The well is the fourth drilled on Cyrenaica Concession No. 6 of Esso Standard (Libya) Inc. The first three were dry holes. But now that the Standard Oil Co. (N. J.) affiliate has a major find, it advised the Libyan Government of plans to bring in a second rig to further delineate the Zelten discovery.

Esso also has been drilling on a block in southern Fezzan, where numerous oil shows and a noncommercial find at Atshan 2 were found last year. Ten wells have been drilled on the concession. The eleventh, El Hadt 1, is now drilling.

Esso has spent about $25 million in its Libyan program. The company has nine concessions covering 25 million acres, acquired after a new Libyan oil law went into effect 4 years ago.

Other companies have spent about $150 million looking for oil in Libya. Several have made finds that may be commercial. Oasis Oil Co. (Ohio) has brought in three producing wells on Block 32, where it is operator for the Conorado group. Gulf Oil Corp. has a find at Emgayet, and Royal Dutch-Shell a discovery at Bir Tlacsin.

All these finds are comparatively close to the Mediterranean Coast, which in turn is close to the world's second-best oil market, Western Europe. Besides Esso's noncommercial find at Atshan, a French company, CPT (L), brought in a noncommercial well on Block 49.

Texas Gulf find . . . The Mobruk 1 find by Texas Gulf is the first blood

in Libya for the American independent, although the company was first to start drilling in the country's oil play.

The 28 bbl. of crude recovered on the only test run so far came from a section of 30-ft. limestone. The company does not yet know how thick the pay is, and fingers are crossed as the well drills deeper into the formation. Age of the pay has not yet been determined.

The 1,106,000-acre Concession 17 lies immediately west of Oasis Concession 32. Texas Gulf has two other Libyan concessions. One of them, the 1,163,000-acre Concession 20, lies 50 miles southeast of the Zelten find.

If the Mobruk find develops into a commercial field, the crude will have an outlet through a joint marketing and participation agreement with Jersey Standard. The deal is subject to Libyan Government approval.

In Azzene . . . On the western end of the North African oil patch, frustrated efforts of a Royal Dutch-Shell company may have a payoff in the westernmost discovery so far made in Algeria.

Cie. des Petroles d'Algerie is conducting prolonged production tests on In Azzene 1, a shallow find made 60 miles east of Adrar on its West Belbel permit. The well came in with an initial flow of 315 bbl. daily from a 39-ft. section topped at 2,378 ft.

The 45°-gravity crude is similar to the oil found in Hassi Messaoud and Edjele fields. The producing horizon is the intermediate zone of Gothlandian, Lower Devonian. Static pressure was 1,330 psi. The rig used on the discovery has been moved 3,900 ft. west, where In Azzene 2 is being started.

CPA, owned 65% by Shell, has had the worst run of luck of any company wildcatting in the Sahara. Thirty-four wells have been drilled in the past 4 years. Most were dry, although some found gas.

If In Azzene or some future discovery on CPA acreage should come in as commercial, Shell will be in a comparatively good position because of its majority interests. Under the new oil law, further foreign participation is limited to 50%. The Libyan law permits 100% participation by foreign companies.

The biggest oil find in the North African oil province has been Hassi Messaoud, where some wells are rated at 40,000 bbl. to 45,000 bbl. daily, and where reserves are estimated at 3.5 billion barrels Hassi R'Mel gas field has reserves rated at 17 trillion cubic feet.

A discovery at El Gassi could become a smaller Hassi Messaoud. The well, drilled by SNPA more than 60 miles south of the Sahara giant, came in at 2,250 bbl. daily from a 243-ft. pay below 10,400 ft.

A cluster of fields in the Edjele area near the Libyan border has been found by CREPS, in which Shell has 35% interest. As in the case of Hassi Messaoud, a 24-in. pipeline outlet is being built to the Mediterranean.

CREPS also has found gas in structures at Berga, Tibaradine, and Djebel Thara deep in southern Algeria.

Iran Opens Another New Area for Leasing

IRAN will give oil companies a chance to bid on more acreage in its vast interior this summer.

It is opening District 8 to competitive bidding from September 1 to November 1. The block is the third being opened to foreign participation. Each of the three Districts, 18, 14, and 8, cover thousands of square miles.

From a geographic point of view, District 8 will probably be more attractive than either of the other two blocks. The center lies about 180 miles from the Persian Gulf, much closer to tidewater than either of the other two districts in case production is found.

District 8 runs from 51° to 54° East Longitude. It is south of District 14, and its southern boundary is the northern border of the consortium area. The only part of the block withheld from bidding is a western corner already awarded to a joint Italian-Iranian company, SIRIP.

Questionnaires which National Iranian Oil Co. will use to ascertain the qualifications of bidders can be obtained from the chairman of the NIOC board of directors at Tehran. This step can be omitted by companies which have previously established their qualifications with the government company.

The specifications booklet and other information needed by bidders can be obtained from Tehran for $2,700 after qualifications have been established. As in the case of Districts 18 and 14, bids must be made under the terms of the 2-year-old oil law.

Three types of bids can be made. The only type successful so far have been bids offering NIOC a joint partnership deal. But bids also can be tendered for an independent application for acreage, plus a bonus offer, or for an offer of limited partnership for NIOC, with a minimum of 30%.

Other districts . . . Bids on District 18 are being accepted from July 1 to September 1. Open dates for District 14 are from August 1 to October 1 (OGJ, May 11, p. 85).

Iran has been ardently wooing foreign participation, but on its own terms. Concessions giving Iran in effect a 75-25 profit split have been awarded to a subsidiary of the Italian state agency, ENI, and to Standard Oil Co. (Ind.). But some of the choicest acreage up for bidding in the Persian Gulf went begging because major companies balked at making a partnership deal with NIOC.

Despite the world-wide surplus of crude, the comparative nearness of huge Middle East fields may make companies weigh carefully the decision of whether to make a play. It may not be a coincidence that the Iranians are releasing some of the details indicating just how good its fields are.

An article in this week's Journal, p. 90, lists the pressures, acreage, and oil columns for each producing field. Gach Saran field may have the thickest pay of any in the world, with an oil column of 7,200 ft.

Two ENI Wildcats Hit Gas

ITALY'S far-ranging state oil company has had some exploration success in its own back yard.

ENI subsidiaries have made two gas discoveries in southern Italy, and report encouraging results in an offshore well from Gela field in Sicily. The finds are a feather in the cap of ENI Chairman Enrico Mattai, who is frequently criticized at home on charges of neglecting local exploration in favor of far-flung foreign ventures.

The gas finds were made in Lucania. The fields are not yet fully defined, but the best one has reserves of more than 360 billion cubic feet. The test off the coast of Sicily was Europe's first offshore well. It is 1¼-miles out from the deep-lying Gela field, which produces about 4,500-bbl. daily of 8.8° gravity crude. A mobile platform used for the first test will start a second well soon.

German Output Up

. . . and so are reserves.

More increases expected.

A GAIN in German crude reserves has made local producers confident they will be producing 110,000 bbl. daily within 4 years.

The latest calculations estimate at least 540 million barrels of recoverable oil as of January 1. This is a net gain of nearly 9% over the preceding year despite steadily growing output. The estimate covers two classes of reserves. Class 1, or proved reserves, have reached 410 million barrels. Class 2, or probable reserves, covers the remaining 130 million barrels. As in the U. S., German reserve estimates invariably have been conservative.

Growing supplies have enabled local producers to continue to step out in front as Western Europe's largest oil country. Current output of 94,000 bbl. daily is more than double second-ranking Austria. Austria led Germany less than 4 years ago, but its production now is declining.

The fields . . . The oil is scattered in comparatively small fields in six different areas. The main regions lie between the Elbe and Weser rivers, between the Weser and Ems rivers, and west of the Ems. Other producing areas are north of the Elbe, in the upper Rhine valley, and in the Alpine foreland.

The most important gains last year were made in the Weser-Ems region. The discovery of Bramhar-Wettrup field and extensions to Vechta fields added up to a net gain of almost 40 million barrels.

Local supplies, however, will not be able to keep up with soaring demand. Domestic output this year is expected to meet about 21% of local needs. But consumption in 1963 is forecast at 640,000 bbl. daily, and anticipated output will fill only 17% of the needs.

Flood Planned in Trinidad

PANOIL Co. of Dallas plans a water-flood project in Trinidad on properties the company has contracted to manage for Premier Consolidated Oilfields, Ltd.

Premier, a British firm, holds 19,000 acres in southern Trinidad. About 1,500 acres are productive. Proven oil reserves were estimated last year at 4,347,000 bbl. and more than 5 billion cubic feet of gas, with a probable oil reserve of 7 million barrels and 15 billion cubic feet of gas.

Besides the water-flood, Panoil plans a general work-over program, development drilling, and several wildcats in the area. Panoil is the former Pan American Land & Realty Co.

Colombia to Get Refinery

THE LAST direct connection between the Colombian Government oil company and International Petroleum Co. will be severed in 1961 when Empresa takes over management of the Barranca refinery.

The 37,500-bbl. refinery originally was part of Intercol's De Mars concession, which reverted to the government in 1951 after 40 years. Since then, the Standard Oil Co. (N. J.) affiliate has leased and operated the plant under a 10-year contract. An expansion and modernization program was completed 5 years ago.

Colombian nationals for years have been training in technical and administrative jobs at the refinery, and the staff problem is not expected to be significant when Empresa takes over direct management. Intercol has its own 28,000-bbl. refinery at Cartagena.

Paraguayan Well Hits Gas

A PARAGUAYAN wildcat being drilled by Pure Oil Co. blew out after hitting a shallow gas pocket, but was quickly brought under control. The test is drilling ahead.

The Mendoza 1 hit a pocket of dry gas at 1,934 ft., and Pure said it considers the small strike mildly encouraging. The projected depth of the test is about 11,000 ft. in Devonian.

The well is located near Fortin Gabino Mendoza in northern Paraguay, near the Bolivian border. Three earlier wildcats were dry holes with no shows. Pure's partners in the 23,200-sq. mile concession are Williams Bros. Co., Paraguay Gulf Oil Co., Sinclair Paraguayan Oil Co., and Tidewater Oil Co. Pure, with 30% interest, is the operator.

FOREIGN BRIEFS . . .

A 920-mile crude line will be laid to provide an outlet for India's big Nahorkatiya field. Oil India Private, Ltd., Digboi, will lay 30 miles of 12-in., 460 miles of 14-in., and 230 miles of 16-in. from Nahorkatiya to Barauni.

A new polyethylene plant with a capacity of 10,000 tons per year has been opened by Monsanto at Fawley, England. The unit will take feedstocks from a new petrochemicals plant at the Fawley refinery of Esso Petroleum.

Nigeria and Shell-BP Development Co. have signed a 50-50 profit agreement which will run for the duration of the company's 30-year leases. The company will pay a 12½% royalty rather than the existing rate of 56 cents per ton.

Bolivian crude is moving in small amounts through a 360-mile section of the crude line running southward from Campo Duran, Argentina. About 2,500 bbl. daily is carried to Tucuman, where it is picked up by rail tank car. When the 923-mile system is completed next year, its initial capacity will be 58,000 bbl. daily.

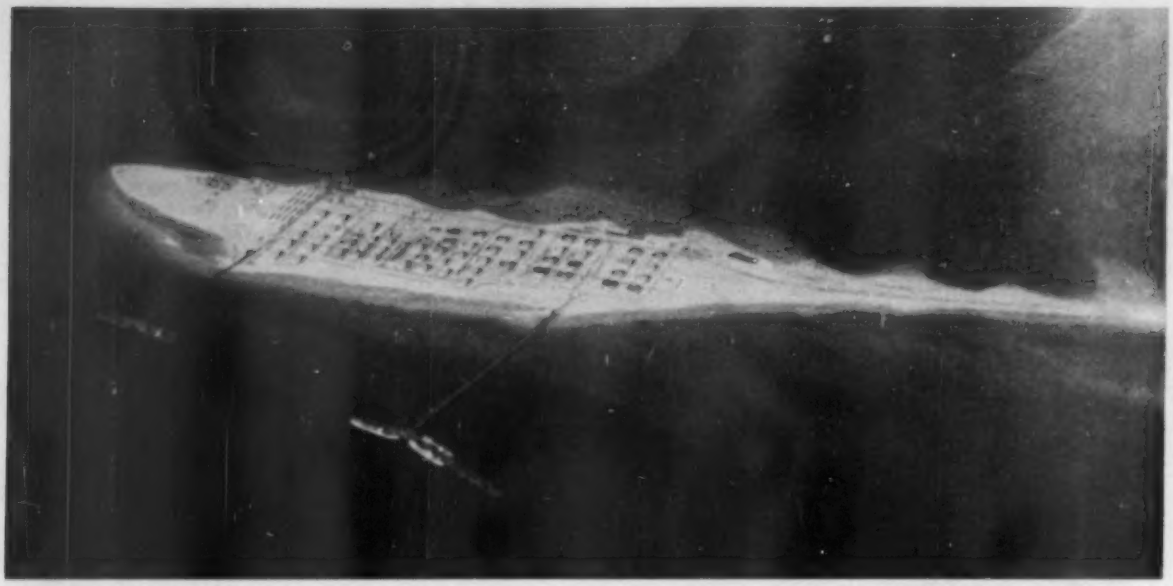
Exploration in Greece has been given up by C. Deilmann Bergbau, G.m.b.H. The German firm had been working jointly with Hellenic Sun in the Greek region of Thrace.

An 84-mile crude line from Comodoro Rivadavia field to Argentina's Atlantic Coast has been started by Pan American International. The 12 to 14-in. system will open with an initial capacity of 12,600 bbl. daily, to be increased to 50,000 bbl. daily by the end of next year.

A new sulfur plant is being built by Royal Dutch-Shell at its Shell Haven refinery in England. The $6-million unit will produce 20 tons of elemental sulfur daily.

The Pan American Land & Royalty Co. of Dallas has changed its name to the Panoil Co. Panoil recently began exploration work on a 1,000,000-acre oil concession in Turkey (OGJ, Jan. 5, p. 89). It also has holdings in Latin America.

A $30-million ammonia plant will be built near Palembang, Sumatra, by Foster Wheeler Corp. under a contract awarded by Indonesia. The plant, to be completed in 1962, will produce 330 tons daily of fertilizer grade prilled urea. Feed will be natural gas supplied by a 60-mile pipeline from Radja field.



THIS AERIAL PHOTO shows how the terminal storage at Aramco's Ras Tanura refinery is just a finger of sand running out from the mainland. When additional tanker berths are completed, the terminal will be able to handle more than 1 million barrels daily.

Ras Tanura: A Key Port in the Persian

- **This thriving city on the coast of Saudi Arabia is the crossroads for much of the Middle East's production, and it also is a bustling refining center that can handle up to 240,000 bbl. daily.**

(Tenth in a series of special foreign reports)

Paul E. Swain
International Editor

ONE OF THE MOST important operational districts in Saudi Arabia doesn't produce a barrel of oil.

Ras Tanura, Arabic for "by the sea," performs multiple functions that far outweigh the fact it doesn't produce any crude. The Ras Tanura district contains the country's only refinery. It is the focal point for the movement of crude through the big Tapline system to Sidon. It handles the movement of almost 134,000 bbl. daily to Bahrain island, and it operates the two big loading piers where last year seagoing tankers lifted almost 340,000 bbl. daily of crude.

All this pretty well splits Saudi Arabian oil production into four separate directions. Ras Tanura is the controlling point.

The refinery . . . Aramco's big Ras Tanura refinery is second in size only to the much older Adaban refinery in the entire Persian Gulf area.

The plant's two 96,000-bbl.-daily crude distillation units, plus a 40,000-bbl.-daily topping unit, could handle a daily throughput of 240,000 bbl. daily any time the company wanted to push them that far. Last year, the daily throughput of the refinery was only 168,119 bbl. daily, a 24,504-bbl.-daily drop from the previous year's throughput.

Aramco says the decreased operating average only reflects the general decline in refining activities in producing areas the world over.

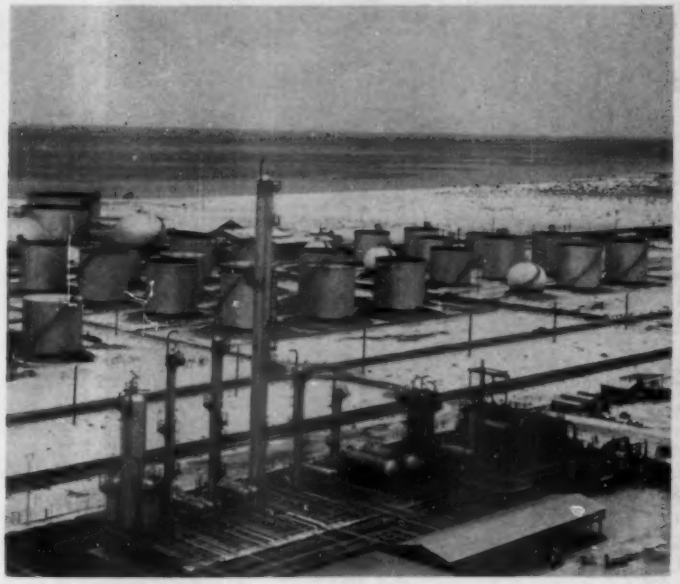
Vantage point for a good view of the refinery is the tower of the 15,500-bbl.-daily fluid Hydroformer, but on a hot day it's not a spot to tarry for long.

The 210-ft. level on the tower gives a bird's-eye view of the entire refinery, including the new 1,200-bbl.-daily H_2SO_4 alkylation plant now under construction. But it's a shaky perch.

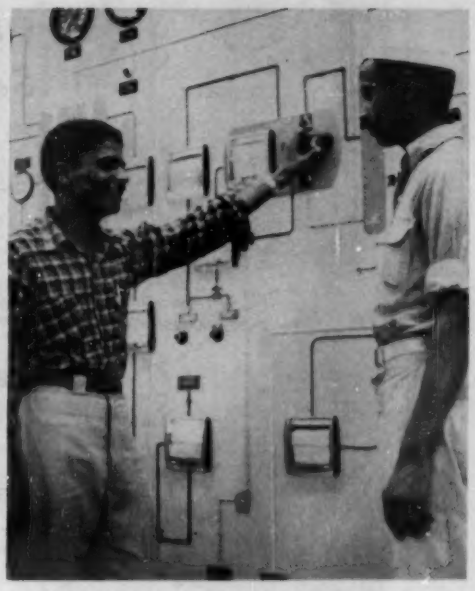
The blast from the unit's stack, plus the vibration of 250 tons of catalyst roaring through the unit's regenerator, doesn't do much to add to one's feeling of stability at that height.

The new alkylation unit will produce enough high-octane alkylate for blending with reformed stock from the plant's two 13,000-bbl.-daily thermal reformers to produce at least 2,000 bbl. of aviation gasoline daily. This is easily enough to satisfy Saudi Arabia's consumption and leave some for export.

Most of the refinery units are cooled with Persian Gulf water drawn into the refinery by a canal extending into the highly saline gulf. Five low lift pumps, each with a capacity of 35,000 gal. per minute, move the water into the canal where the ever-present sea weed and jelly fish are strained out. Then five steam-driven high lift pumps move the water at 40 psi. into the refinery proper.



A NEW alkylation unit is almost ready to go on stream. The 1,210-bbl. unit will provide high-alkylate blending stock for the two 13,000,000-bbl. thermal reformers at the refinery.



AT THE CONTROLS of a fluid Hydroformer are two Saudi workers, Farraj ben Turkey, left, operator of the unit, and Abdullah ben Ali, a trainee.

Gulf

The terminal . . . The big offloading improvement at Ras Tanura's terminal is the addition of an 800-ft. extension to the 1,360-ft. north pier to provide two additional tanker berths.

The additional berthing space increases the terminal's loading capacity to more than a million barrels daily from a total of 10 berths on both piers.

The Ras Tanura terminal storage now totals more than 7,300,000 bbl. of both crude and products. Additional storage will be needed each year to handle the expected increases in crude export.

The narrow spit of sand that holds the terminal storage juts out into the gulf from the refinery itself and serves as the causeway for product lines from the refinery and crude lines from the Qatif pump station to the south, Dhahran, and from Safaniya to the north.

PAUL E. SWAIN, left, the Journal's international editor, discusses operation of the plant with Dick Lee, Aramco refinery engineer.

STANDING on a platform high up on the fluid Hydroformer, Swain and Lee get a bird's-eye view of the big refinery.

THIS IS A PICTURE of the Iranian oil industry as it stands today. The new areas now being offered for bids are Districts 8, 14, and 18. Portions of District 1 (offshore), 3, and 4 are also open.

Iran opens new areas for operating agreements

Here's a report on the geology and prospects of the areas

BY G. E. CRAYS, G. W. UNDERWOOD, AND T. B. YOUNG
Technical Advisors to Management
National Iranian Oil Co.
Teheran, Iran.

IRAN, one of the last major oil frontiers in the Middle East, has recently declared three large areas, Districts 8, 14, and 18, available to foreign capital for operating agreements.

In comparison to most of the other promising areas now accessible to the operating companies, Iran offers numerous distinct advantages. It is geographically adjacent to but politically outside the Arab sphere and has the most stable internal political situation in the area. While certain other countries have adopted, and continue to create, tax and other conditions increasingly unfavorable to outside capital, Iran has revised her statutes and the petroleum law embodies regulations highly conducive to pleasant and profitable relationship between foreign operators and government.

Sedimentary basins in which the environment is favorable for the occurrence of petroleum cover more than 312,000 sq. miles (198,000,000 acres) on the continent and 39,000 sq. miles (24,950,000 acres) along the Continental Shelves of the Persian Gulf, Gulf of Oman, and the Arabian Sea.

To the present, operating agreements have been entered into for areas totaling about 66,000,000 acres on the land and 5,680,000 acres of

GENERALIZED COLUMNAR SECTION FOR IRAN. FIG. 1

AGE	FEET THICK	STRATIGRAPHY	OIL AND GAS POSSIBILITIES IN DISTRICTS 1, 3, 4, 8, 14, AND 18
RECENT PLEISTOCENE	0 TO 1,800	Beach and terrace gravels, mud flats, alluvial fans, sand dunes, fresh-water limestones, lava flows.	POOR
PLIOCENE	0 TO 9,000	Conglomerate, sandstone, marl, lignite, rare lava flows.	POOR
MIOCENE	0 TO 20,000	Marl, siltstone, sandstone, all mostly red in color, thin limestones, some gypsum and salt, rare lava flows and tuffs.	POOR
OLIGO-MIOCENE	0 TO 9,000	Limestone, reef limestone, marl, thin bituminous shales, salt, anhydrite, rare sandstone and conglomerate, gypsum, local lava flows.	EXCELLENT The Oligo-Miocene of Central and northern Iran includes the equivalent of the Asmari limestone, the prolifically productive horizon of the southern fields where a reserve in excess of 26 billion barrels has been proven. In District 18 this zone is estimated to be 800 m. (2,400 ft.) thick, and more than 1,200 m. (3,600 ft.) is present in the Zagros Mountain front west of Districts 8 and 14.
OLIGOCENE	0 TO 7,500	Dark red marl and shale, salt, anhydrite, sand, gypsum, siltstone, conglomerate, local lava flows.	POOR
EOCENE (PALEOCENE)	0 TO 6,000	Limestone, reef limestone, sand, shale, conglomerate, highly volcanic with flows, tuffs, and breccias. "Flysch" sandstones, shales, and limestones, frequently with giant breccia, in southwestern Iran.	FAIR The Eocene of Central Iran is generally lagoonal or shallow marine in its origin but there are local areas of more normal marine sedimentation in which petroleum possibilities should be good. The section is increasingly deeper marine to the south and east and moderately good production occurs at Masjid-i-Sulaiman.
CRETACEOUS	0 TO 12,000+	Dark shale, limestone, reef limestone, marl, dolomite, chert, local "flysch" sandstone and shale, and highly colored giant breccia.	GOOD Seeps from Cretaceous are fairly common. Shows have been found in wells reaching rocks of this age and good production from Cretaceous at Lali, Agha Jari, and Masjid-i-Sulaiman establish it as a good prospect elsewhere. The certainty of gradation of the Lower Cretaceous calcareous facies of Iran into the prolific clastic facies of Saudi Arabia, Kuwait, and southern Iraq creates impressive possibilities for Iran's offshore districts in the Persian Gulf, part of which are still open for agreements.
JURASSIC	0 TO 9,000	Limestone, dolomite, colored shales, black shale with coal, sandstone, conglomerate. Commonly bituminous. Frequently highly metamorphic.	FAIR A few seeps occur from Jurassic rocks, some adjacent to District 18. The sediments are marine and development of the highly productive clastic facies of Saudi Arabia is always a good possibility, especially in the offshore areas.
TRIASSIC	0 TO 3,000	Limestone, dolomite, marly limestone, sandstone, conglomerate, quartzites. Local volcanics.	POOR
PERMO-CARBONIFEROUS	0 TO 3,000	Limestone, dolomite, dark shales, local coal lenses, conglomerate, local igneous sills.	UNKNOWN
DEVONIAN	0 TO 1,000	Red sandstone, red and gray quartzites, red shale, dark shale with local coal, siliceous and dolomitic limestone.	UNKNOWN
SILURIAN ORDOVICIAN CAMBRIAN	0 TO 6,000	Limestone, fetid organic dolomite, siliceous dolomite, shales, sandstone, gypsum, salt, tuffs, gneiss, schist, metamorphics. Salt in southern diapirs may be Cambrian.	UNKNOWN
PRECAMBRIAN		Granite, basic igneous, gneiss, schist.	

"On the whole, Iran is a geologist's paradise"

FLYING OVER IRAN one sees such textbook structures as these. The western closure and plunge of the Namak anticline is clearly apparent. To the right is the enormous Kuh-I-Namak salt mountain, a diapiric salt plug. It lies about 40 miles north of the northwest corner of District 14. Fig. 2.

the shelf. The remaining area, in excess of 152,000,000 acres, is being systematically explored by Iran Oil Co., NIOC's operating subsidiary, with the object of retaining part as national reserve and committing the remainder to other interests under additional operating agreements. The present offerings are part of this area, and portions of Districts 1 (offshore), 3, and 4 are still open.

From the standpoint of the foreign oil operator one of the pleasantest aspects of doing business in Iran is the fact that the government's interests are administered by NIOC which, although 100% owned by the Government of Iran, is constituted as an independent commercial and nonpolitical organization manned by oil people. This avoids the delays, misunderstandings, inefficiencies, and frequent downright frustration so often encountered in countries where the petroleum policies are interpreted and administered by a political group with little or no real understanding of the oil business and its problems.

Procedure . . . The procedure for opening a district to agreements is twofold. First is a preannouncement period of 3 months at the end of which prospective bidders may obtain the geological brochure, and other official forms necessary for submitting a bid, from the exploration and production division of NIOC. This is followed by a 2-month consideration period during which proposals are prepared and submitted. The preannouncement of the opening of District 18 was made April 1 of this year.

In the preannouncement for District 18 it is stated that no bids will be accepted after the closing date of the 2-month consideration period. This is somewhat misleading. Actually when a district has been declared open for agreements, bids must be accepted any time up until the district has been officially withdrawn by a 3-month notice to that effect. The preannouncement statement is related to priority of consideration, that is, any bid received after the closing date of the initial period will not be considered until all bids received during the specified time have been processed and decided upon.

Salient Points of Petroleum Law

The Petroleum Act of July 31, 1957, was designed for the purpose of expanding, as rapidly as possible, petroleum exploration and production throughout the country and on the Continental Shelf of Iran in the favorable areas not included in the consortium district as defined by the Agreement for the Sale of Oil, dated October 29, 1954.

The act also was intended to promote expansion of refining, transportation, and sale of oil and products throughout the nation and abroad. To accomplish this, numerous guarantees, favorable to the foreign operator, were incorporated in the law. The most important of these are the limitation of income taxes to 50% of net, freedom from other taxation, no import duties on operating equipment, no restriction on foreign exchange, and complete stability of initial agreement terms for 30 years.

The petroleum law is not complex but direct and coded to be adjustable to the many conditions that arise within the complexities of integrated oil operations in a vast country that has within its borders everything from accessible Persian Gulf tidewater and Continental Shelf to remote mountains.

Types of agreements . . . Within the legal structure of the Petroleum Act, three types of operating agreements are permitted to function in the oil business; but because only two of these have so far been selected by the new operators in Iran, there has been perhaps some misunderstanding of the full scope of legislation within which companies may now work. (See Table 1.) In effect there is (1) 50% participation with NIOC, (2) less than 50% but more than 30% participation with NIOC, and (3) no NIOC participation. Either a mixed organization or joint structure is possible in the case of NIOC participation.

Geology and Petroleum Prospects of New Districts

On the whole, Iran is a geologist's paradise, with almost a complete geological column from Precambrian to Recent (Fig. 1), outcropping at the surface in a wide variety of rapidly changing facies, and a complex tectonic pattern, with fairly sharp folding as late as Quaternary in some localities. The tectonics are shown in a multitude of beautiful surface structures, thrust and normal faults and numerous diapiric salt domes (Fig. 2). Some of these reach the surface to form glistening peaks of rock salt, some 3,000 ft. high.

The mountains are moderately to very high, rugged, and intricately deformed. Folding was almost wholly compressional with reverse faulting the rule and major overthrusts quite common. As a result the regional geological map is a veritable phantasmagoria of structure with more than 200 surface closures already mapped along the Zagros Mountains alone.

THREE TYPES OF OPERATING AGREEMENTS IN IRAN. TABLE 1

	Mixed organization or joint structure minimum NIOC interest=50%	Mixed organization or joint structure NIOC interest=30—50%	Independent operation, no NIOC interest
1. Maximum area district	3,952,000 acres	2,203,000 acres	1,605,500 acres
2. Operator's max. net-interest/district	1,976,000 acres	1,605,000 acres	1,605,500
3. Maximum number districts/operator	5	5	5
4. Maximum area—all districts	19,760,000 acres	11,115,000 acres	9,027,500 acres
5. Operator's max. net-interest/all districts	9,880,000 acres	9,027,500 acres	9,027,500 acres
6. Duration of agreement	25 years from date of commercial production	Same	Same
7. Extensions	3 or 5 years each—first extension has original-terms	Same	Same
8. Cash bonus	May not be required	To be determined by NIOC considering each case on its merit.	Same
9. Annual rentals	Determined by NIOC but deductible as operating costs or may pay NIOC share of exploration costs in lieu of rentals up to agreed amount.	Same	Determined by NIOC
10. Well requirements	Start well in each district in 4 years & continuous development thereafter.	Start well in 5 years and one well per year per district thereafter.	Same
11. Final holdings	One-half of total area entrusted must be turned to NIOC within 10 years from agreement and return all of each area that does not have commercial production after 12 years.	One-half of total area entrusted to be returned within 10 years but not to retain more than 247,000 acres per area. Return all of each area that does not have commercial production within 12 years.	Same
12. Income tax	For first 50 years, not more than 50% of net earnings.	Same	Same
13. Taxes	Except for income tax operator is exempt from all charges, duties, license, etc. throughout agreement and first extension.	Same	Same
14. Guarantees	No changes adverse to operator may be applied during term of agreement. All needed materials and equipment imported license and tax free. No tax on petroleum products. Operator owns oil at the well head. Monetary exchanges to be freely conducted at current free market. No restriction on import or export of U. S. dollars or other monetary unit.		

The intervening basins are broad, generally flat, alluvium-covered plains through which surface structures penetrate as local areas of moderately to sometimes very rough topography. Salt marshes occur along the normal outcrops of the extensive evaporite series but the salt peaks are always associated with local structures.

The flat desert of District 18 is a locality of strong tectonics with many surface structures and some faulting, all so prominent as to be readily discerned on aerial photos (Fig. 3). The mountains on the northern, eastern, and southern boundaries are complexly deformed and the western part of the district includes a number of salt peaks and domes (diapiric) associated with the strongly folded south Semnan area.

Districts 8 and 14 are similar to 18 in general characteristics except the basins are more elongated, and better watered. Surface structures in the valleys are less common because the thick mantle of fans, mud flats, and salt marshes rather thoroughly mask the underlying deformation. Very late folding is, however, evidenced by dips in some of the recent gravels.

Petroleum prospects of all three districts are more or less the same. As previously stated, all abound in favorable structure and each has, to the best of present knowledge, similar stratigraphy. Productive potential of the rocks of various ages, as inferred from experience in Iran and nearby countries, is shown in the right-hand column of Fig. 1.

Prior exploration . . . Due to the tremendous producing capacity of the southern fields, and their proximity to tidewater, early exploration and development was concentrated there. Central and northern Iran were more or less ignored until the last few years when the rapid growth of Teheran and vicinity with its huge increase in consumption of petroleum products emphasized the necessity of developing production in the north to avoid the long haul from Abadan.

After some years of preliminary geological studies, Iran Oil Co.,

"NIOC is planning the early construction of a new refining unit

NIOC's operating subsidiary, commenced actual exploration. To date, most of the drilling has been in the vicinity of Districts 8, 14, and 18. The now-famous blowout of 5 Alborz, on the Qum structure south of Teheran, definitely proved prolific potential for the Oligo-Miocene in Central Iran when it flowed upward of 5,000,000 bbl. of oil in 80 days before bridging and killing itself. Failure to retap this tremendous reservoir during the time since the loss of No. 5 has been largely due to extraneous circumstances which in no way derogate the potential of the field.

The first test on the Sarajeh structure, similar to Alborz and some 30 miles southeast toward the northern boundary of District 14, was lost when it became necessary to cement the well to shut off high-pressure-gas leakage which developed an incipient crater (with gas, water, and mud geysers at the surface as much as half a mile from the hole) while the top few feet of the Oligo-Miocene formation was being tested. A second well on this structure has recently been completed as a high-gas-ratio well producing 53°-gravity, paraffin-base oil. Succeeding tests will be drilled sufficiently low on the flanks to encounter the Oligo-Miocene in the oil column.

Since the structural and stratigraphic conditions in Districts 8 and 14 are similar to those of Alborz and Sarajeh, the Oligo-Miocene possibilities there certainly appear highly favorable.

A test on the Semnan structure, about 36 miles west of the northwestern part of District 18, found a small amount of oil and gas per day in a thin section of Oligo-Miocene limestone lying directly on the Eocene. The Oligo-Miocene is known to thicken rapidly to the south, east, and west from this locality and prospects for the zone in District 18 are considerably enhanced by such a favorable showing so near the outcrop of the formation.

Cretaceous limestones in the mountains along the south of District 18 show extensive reef development and possibilities for reef limestone accumulations in rocks of this age appear quite favorable.

Other Areas

Considerable acreage is still available for operating agreements in District 1, on the Persian Gulf Continental Shelf of Iran. IPAC and SIRIP have agreement areas in the northernmost part of this district. Both companies have made detailed seismic and stratigraphic studies, coordinated with surface investigations in the adjacent land area. Results obtained have apparently been favorable as SIRIP is driving piles in water 13 to 18 ft. deep for a drilling platform and IPAC has a self-contained barge unit in tow from the United States which should be on location by the time this article is in print. The SIRIP platform will be equipped with an Ideco Super 7-11 rig capable of drilling below 15,000 ft. and should spud very soon. The IPAC drilling unit will have a similar capacity and be operated by Seacat International Drilling Co.

A large portion of District 3, where SIRIP and IRCAN have areas under agreement, is still open as is all of District 4. Both of these districts are in extreme southern Iran where production would have direct access to tidewater and a considerably shortened tanker distance both to the Mediterranean and the Far East.

Reserves—Reservoirs

De Golyer & MacNaughton, in Twentieth Century Petroleum Statistics, 1957, estimated proven oil reserves of Iran to be 26,000,000,000 bbl.;* however, this is a most conservative figure. It is noteworthy that these huge reserves are contained within seven reservoirs most of which have been producing for a good many years. (See Table 2.)

The Agha Jari and Gach Saran oil fields will ultimately produce several billions of barrels of oil each. Haft Kel is probably more than a 2-billion-barrel field, as is Masjid-i-Sulaiman.

At Agha Jari the present production is in the order of 557,000 bbl. of oil per day with only 28 wells, an average of 18,900 bbl. oil per well per day. The allowable for this field for 1959 was set at 707,500 bbl. oil per day. Production for individual wells is generally limited by size of flow line and casing in the well.

Production is largely from Asmari limestone rocks of Oligo-Miocene age but there is also some Eocene and Cretaceous oil being produced.

The Agha Jari anticline, similar to the other producing structures in this province, is typically a long, narrow, slightly asymmetrical fold with the long axis oriented northwest. Proven productive area is roughly 30 miles long and about 3½ miles wide. Thickness of the producing section is probably 1,000-1,250 ft. but could be more as there has been no drilling to the oil-water level.

Gach Saran is believed to be at least 28 miles long and 5 miles wide with about 1,550 ft. of reservoir rock and 7,200 ft. of oil column.

Production factors . . . Though rates of production from wells in all fields are high, there is wide spacing to give a relatively low total reservoir offtake. In some cases potential rates are less than 1% per year of original oil in place.

*The Oil and Gas Journal, Vol. 26, No. 52 (Dec. 29, 1958), estimates proved oil in Iran to be 33 billion barrels.

SUMMARY OF

	M-I-S	Lali	Haft Kel	Naft Safid
Discovered	1908	1938	1927	1938
Began production	1911	1948	1929	1945
Above sea level, ft.	800-1,900	500-1,900	800-1,500	300-1,400
Depth to top of Asmari, ft.	650-5,300	4,000-9,000	1,900-4,900	3,000-7,000
Avg. thickness, ft., Asmari	1,000	1,200	900	900
Cum. prod., bbl.	1,110,829,000	± 30,500,000	± 1,200,000,000	81,389,284
°API gravity	37.8	35.8	38.5	35.5
Present oil column, ft.	500	2,000	950	975
Present psi. reservoir press.	550	3,150	1,350	3,030
Present daily prod., bbl.	40,000	15,574	132,700	62,900
No. prod. wells	29	4	20	13
Avg. prod. per well per day, bbl.	2,750 ±	3,893 ±	6,635 ±	4,838 ±

*Produced by NIOC. †Figure is for Iran side of structure—does not include portion in Iraq which may be more. ‡Discovered by IOC, subsidiary of NIOC but not yet developed.

of 40,000 bbl. per day in the vicinity of Teheran

IRAN'S OIL FIELDS, TABLE 2

Agha Jari	Gachsaran	Naft-i-Shah*	Alborz*‡	Sarjeh*‡
1936	1928	1927	1956	1958
1944	1940	1935	.....	.....
340-1,340	2,100-2,550	500 ±	3,004	2,624
4,000-10,000	2,600-10,000	2,100-3,300 (Kalhur lms.)	8,783 (Oligo-Miocene)	7,902-8,050 (Oligo-Miocene)
1,000-1,250	1,550	250 (Kalhur lms.)	Not known	Not known
±1,000,000,000	±185,000,000	±40,000,000	§5,000,000	.....
34.8	32.9	41	45.8	53.7
3,000	7,200	700	.....	.....
3,030	3,470	2,000	8,500+	6,200
529,700	57,500	†6,000	.....	Waiting facilities
28	4	3	.....	1
18,900	14,375	5,670	80,000 +	40,500,000¶ 2,828

§Blowout—5 Alborz. ¶Cu. ft. of gas, open-flow potential.

Reservoir drive is by expanding gas cap with rather ineffective water drive in fractured limestone that has a matrix permeability range of 0.00001 to 10 md. and porosity estimated to average 13%, including fractures and matrix. The fissure system, though complex, makes good connection between wells as demonstrated by small pressure differential throughout reservoirs.

Wells are normally completed after acidizing with several thousand gallons of hydrochloric and the productivity index is usually about doubled after acid treatment.

A recent completion at Agha Jari had productivity index of 1,020 bbl. per psi. drop in flowing to static bottom-hole pressure at producing rate of 25,500 bbl. of oil per day. The 53 Agha Jari was recently completed for 40,400 bbl. of oil per day producing through 8½-in. open hole.

That there is commercial oil in the Central Iranian basin was first proved in August 1956 (OGJ, Jan. 21, 1957) when well No. 5, on the Alborz anticline near Qum, blew out and produced in excess of 5 million barrels of oil at an estimated daily rate of 80,000 bbl. before the well bridged and was closed in.

A second structure, Sarajeh, was proven productive by tests made in well No. 2 which in the interval 8,033-38 ft. produced 331 bbl. of 53.7° oil with gas : liquid ratio of 16,883 to 1 and deeper in the same reservoir, from 8,545-86 ft., produced 441 bbl. per day of 53.5° oil with gas-oil ratio of 14,000 to 1. Open-flow potential of this interval is calculated to be 40,500,000 cu. ft. of gas with 2,828 bbl. of oil per day. In size, the Sarajeh structure is comparable to the major fields in the south of Iran with an indicated productive area of more than 29,000 acres.

Outlets and Markets

Consumption of petroleum products in Iran is increasing at a rate of 15% annually while over-all increase in the Middle East is 12%. In 1958 Iran required about 18¾ million barrels of petroleum products. It is estimated that in 1965 this figure will be 45 million barrels and by 1975 nearly 150 million barrels per year will be needed.

The Abadan refinery of the consortium has throughput capacity of about 514,000 bbl. per day. In March 1959 the average daily runs were in the order of 342,000 bbl., most of which went to export. There is storage for 27,500,000 bbl. of crude and products at the refinery.

NIOC's Kermanshah refinery can process 5,000 bbl. of crude per day and NIOC is now planning the early construction of a new unit of 40,000-bbl. per day capacity in the vicinity of Teheran.

In the consortium area Bandar Mashur has six loading jetties with high-rate loading systems, bunkering facilities, storage tanks, and other auxiliaries. Storage is provided for 577,000 bbl. of diesel and fuel oils. Two new jetties with crude storage for 577,000 bbl. have recently been completed, thereby increasing over-all crude-storage capacity to 2,875,000 bbl. The rated shipping capacity of the port, including the new jetties, is 600,000 bbl. per day.

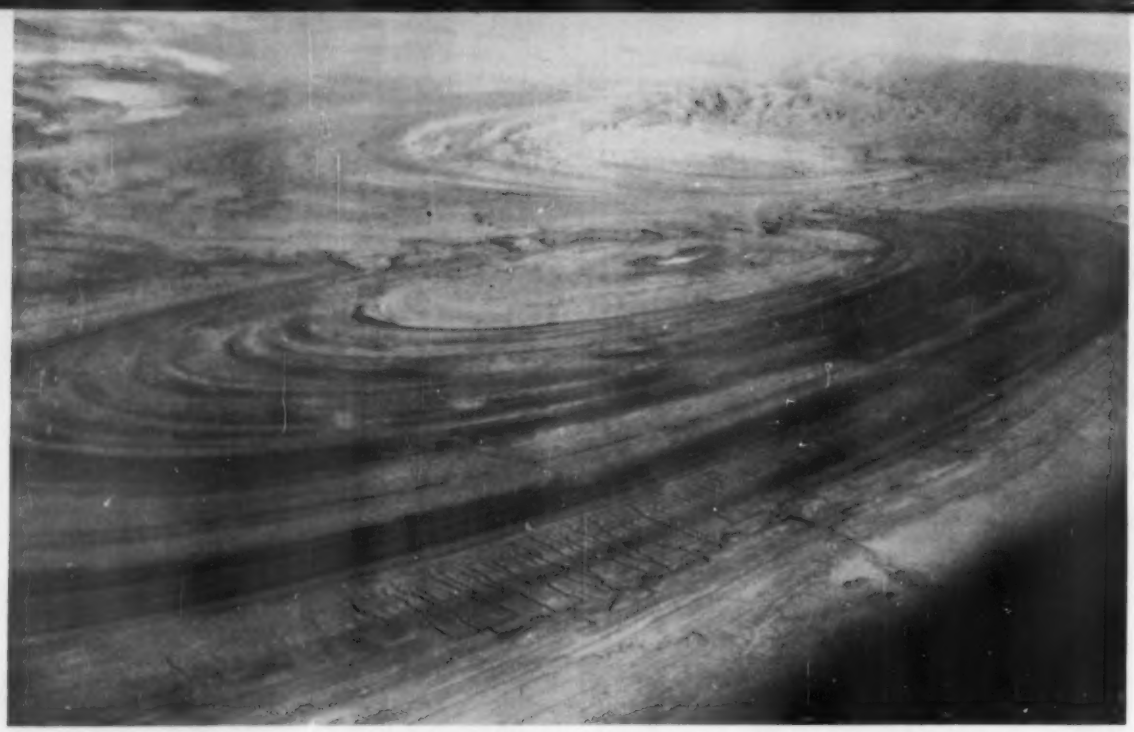
A new loading terminal being built on Kharg Island will be capable of handling the largest tankers (over 100,000 tons) in use or under construction, and provides for gravity loading of ships. The 26 and 30-in. pipeline to Kharg Island will have initial daily capacity of 377,000 bbl. and the tank farm will have storage for 2,500,000 bbl., with loading facilities and berths for four tankers. However, space is available so that storage and loading can be substantially increased and the island is large enough for other companies to install similar facilities.

There is a 509-mile 10-in. pipeline from Ahwaz to Teheran with annual capacity of 18 million barrels, and 6-in. branch lines are being built to Isfahan (138 miles) and Resht (218 miles). (See map.)

Where neither pipeline nor railway is available transport is by road trucks, except for the coastal districts of the Persian Gulf where supplies are carried by self-propelled tankship and seagoing barges towed by tugs. In Iran there are more than 1,200 points where oil products are stored and made available for sale. Storage at these points is for more than 3,150,000 bbl. of oil products.

The outlook . . . Estimates were published by Chase Manhattan Bank in November 1958 to the effect that the Free World markets will consume 29.5 million barrels of oil daily by 1967 and it is not unreasonable to assume that Iran is to share that market in proportion to its proven reserves, or 15%. Therefore, it is expected that Iran may be exporting nearly 4.5 million barrels of oil per day by 1967 provided production, transportation, loading, and market in this magnitude have been developed.

National Iranian Oil Co. has plans to build a 36-in. pipeline from Qum, on the Central Iranian plateau, through Turkey to the Mediterranean port of Mersin, at a cost of some 500 million dollars. The line will be available for use as a common carrier for all oil producers in Iran and particularly those in the central parts of the country. Initial annual capacity will



HERE'S ANOTHER textbook anticline. This is the Gatchab structure, typical of those in North and Central Iran. Gatchab lies 60 miles north of District 14 and 60 miles west of District 18. Fig. 3.

be 150 million barrels with plans for increasing to 225 million barrels, about 620,000 bbl. per day, when required.

With pumping capacity of 225 million barrels per year, cost to move oil through this 36-in. line will be 42 cents (U. S.) per barrel, plus a reasonable tax to the Turkish Government, during the first 10 years while the line is being amortized. After the amortization period, oil will be transported for 25 cents (U. S.) per barrel.

Present tanker charges from Ras Tanura to eastern Mediterranean ports are 54 cents (U. S.) per barrel.

Drilling Supply and Service

Drilling in Central Iran does not present unusual or complicated problems and has generally been in the range of 8,000 to 10,000 ft. A few holes have been drilled deeper, 7 Alborz reaching 13,216 ft. to be the second-deepest hole in the Middle East (deepest is Aramco's 1 ST in the Rub al Khali at 14,750 ft.).

Drilling equipment for use in Central Iran should have a minimum capacity of 12,000 ft. Pressures ordinarily range from 6,200 to 7,500 psi. at 8,000 ft. and below. Surface hookups should include control equipment with minimum of 5,000 lb. working pressure and heavier equipment may be necessary in some instances.

Although there are no oil supply houses in the ordinary sense, and most material and equipment must be imported by the operator, representatives of all branches of the industry are established in Teheran, or nearby areas, to facilitate and expedite procurement. By law all material imported for operations comes into the country free of import taxes or duties. Logging, cementing, and perforating services have men and equipment on the ground. Subsidiary supplies such as cars, trucks, heavy equipment, small pumps, tools, cement, small-diameter pipe, fuel, lubricants, etc., are available in plenty on the open market.

Penetration . . . Rates of penetration are from the maximum of 12 to a minimum of 3½ ft. per hour while drilling through the upper shales and clays which contain stringers of marl, sandstone, and siltstone. When drilling 12¼-in. hole in this section bit life will average from 800 ft. in the top hole to 70-80 ft. at a depth of 7,000 ft. In the evaporite section below the shales penetration rate is voluntarily controlled and in the marly limestone and limestone sections varies from 1.45 to 2.80 ft. per hour.

Fresh-water mud, having a weight of 75 lb. per cu. ft. (10 lb. per gal.) and viscosity of 45 seconds, can be used for drilling the upper sand, shale, and mudstone section. Weight is gradually increased as the evaporite section is approached and then saturated with salt to maintain the hole in proper gage. Mud weight is again reduced, by watering back, when the underlying limestone and marl section is drilled, the hydrostatic pressure being kept just above formation pressure, either actual or anticipated.

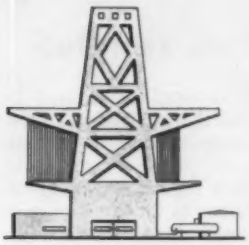
Casing . . . Three strings of casing are generally used in this area. The most common program is 13⅜, 9⅝, and 7-in. Variations in this are at option of the operator and might include conductor pipe and a liner in place of a full production string.

Typical drilling data . . . The following composite summary, which could be utilized in programing the drilling of an 8,500-ft. well in this area, was prepared from the facts revealed in a detailed study of the drilling record of several wells:

Hole size, in.	Depth, ft.	Formation	Penetration, No. bits	Penetration, ft. per hr.	Mud wt.	Casing, in.
17½	2,500	Shale and clay	6	6.00	75	13⅜
12¼	5,000	Shale and clay	16	5.86	100	.....
	6,000	Shale and clay	..	.....	125	.....
12¼	7,000	Evaporite	22	4.78	125	9⅝
8½	8,500	Marly limestone and limestone	13	2.20	110	7

ACKNOWLEDGMENT

The authors gratefully acknowledge the consideration of the directors of National Iranian Oil Co. and Messers. Naficy and Farkhan, of the exploration and production division, for permission to publish this article.



ROTARY-RIG DESIGN

These comments are from a discussion presented to the South Texas Section of the ASME at Houston. Moderator of the panel was Paul Courtney, general manager of Cardwell Manufacturing Co., Houston. Members of the panel were T. B. O'Brien, staff chemist, Gulf Oil Corp., Houston; R. O. Childers, general drilling superintendent, Atlantic Refining Co., Dallas, and J. K. Butler, president, Oil Production Maintenance, Inc.

Could we profit from a different manpower-horsepower combination?

T. B. O'brien says...

IT IS HARDLY LIKELY that any one here will propose any great change in the manpower-horsepower relation on drilling rigs. True, there is a desperate need for improvement in feet of hole drilled per man-hour and per horsepower-hour. At the same time, there is need for reduction in maintenance and repair costs.

We can expect no panacea in the form of some new tool or radical new rig design, but we can expect a gradual improvement on all sides.

The greatest single improvement that could be made would be an inexpensive one from the point of investment, yet would yield the greatest profit. That is proper education and training of both operator and contractor personnel.

New developments often take 5 years to become established. A few operators demand and perhaps pay extra for a change that improves drilling. A few contractors on occasion even risk trouble with the operator by making the improvement. Many others on both sides wait until they are forced to use a new technique and some go out of business because they will not change.

A number of management people and engineers, or combination of these, will recognize the value of many techniques that are available, but these same techniques are seldom applied on the rigs for which these people are responsible. They may never be tried until some new operator moves into the field and drills wells for a lower cost. Then, whoever controls the purse tells the drilling man there will be lower drilling costs or there will be a new drilling man.

To follow a practice in a field just because it is established is expensive. Each operator and contractor alike might be well advised to hire a man to go from rig to rig or field to field and be sure that each superintendent, pusher, and crew is up-to-date on the best techniques. Further, he might make a point of eradicating some of the expensive witchcraft that afflicts the industry. A second man should follow the first to insure the application of the better techniques.

Selection of new equipment or alteration of existing equipment either to replace workmen or to increase the size of the rig should be viewed very carefully. Labor cost on a rig runs fairly close to $1 per foot and investment equipment about $1.50 per foot. Remaining footage costs go to maintenance, expendables, overhead, and we hope, a reasonable profit. The labor figure quoted includes the pusher, so any addition of equipment which replaces a man can cost no more than $0.16 per foot. That 16 cents includes investment, operation, and maintenance. Also included must be rigging-up and moving costs for the item. With all these costs added together, if the cost is close to $0.16 some improvement in average footage per day must be realized.

Increase in rig size is justifiable so long as a reasonable balance of equipment is maintained. For instance, adding large engines and pumps to a rig without improving the transmission system or using better-adapted drill pipe can easily lead to trouble.

The industry as a whole is not ready to make sweeping changes that would make rigs automatic, but designers of equipment that control a rig might well start development in that direction. Only one thought need be kept in mind: Every item added has to reduce the over-all dollars per foot, whether by increasing feet or reducing dollars.

It could be done . . . It is now technically feasible to build a drilling rig for any depth rating and which can be operated by one man. It quite probably could be maintained by no more than one mechanic. There is no great problem here as far as design and manufacture of equipment and control devices are concerned. Much more complicated operations are performed by completely automatic machines than are ever required on a drilling rig.

Indeed, it is understood that an automotive-plant engineer has designed and is ready to build a drilling rig of this type. It is a land rig of the 10,000-12,000-ft. class and is basically the same as our conventional rig. By that I mean it is a rotary rig using drill pipe and circulating a drilling fluid.

There are several reasons why he will not sell these in such lots that he will have to worry about space for long serial numbers. First, the rig will cost several million dollars. Second, it will probably make little more hole per day than a conventional rig. Third, upkeep will be higher and failures more frequent than on present equipment. Fourth, very few contractors and probably no operators at all will like the looks of the rig.

Resistance to change . . . We will all make various excuses about it, but basically our trouble is that we just hate to try anything new. There are numerous operators and contractors alike working along the Gulf Coast who still do a shabby job at best of applying what we presently know of

"Drill-string design is far ahead of field practice."

hydraulics. Bit weights are very often far below the optimum. How many contractors have tried the turbodrill without backing from some operator? How many ran high jet velocities before it was required of them?

How many contractors give their tool pushers and rig crews instructions in new developments in the drilling business? I still hear pushers and drillers say that more mud weight is required to hold down a given formation pressure if a small hole is being drilled than if a large one is being drilled. Contract and company pushers alike have griped much more about low-water-loss muds than about excess mud density. Yet the effect of excess mud density on drilling rate is much greater than the effect on reduced fluid loss.

So, before we scream too much for new equipment or techniques, let us be sure we understand and are using to the best advantage that which we have.

There is some logic in resistance to radical changes in this business where the failure of an apparently insignificant part can be extremely costly. We can expect, therefore, more or less gradual changes rather than sweeping ones. One mark of a good drilling man is the ability to recognize the value in new equipment and techniques which have merit, and more, to be certain that each man working for him has an appreciation for, and makes full use of, every improvement available to him.

Where changes might come . . . Let's look quickly at the major items of rig equipment, with possible changes in mind that might alter the present manpower-horsepower ratio.

First, the source of horsepower—the drive. Practically every rig now in use, whether new or old, will work beyond its design limit at least once in the next year. When this occurs, maintenance costs are abnormally high. The cost of adding special equipment to most present-day rigs for only one well is prohibitive. Generally, if a piece of equipment is needed for a short period of time its power must be supplied by a separate source, although ample power may be sitting idle. Such extra expense stifles adaptation to new conditions.

Alternating-current electric units recently developed in Europe may prove quite a help in this connection. But they are still several years away.

In the meantime mechanical and electric rigs purchased for use in this country should provide for easy placement of special units as an addition to, or a substitute for, standard equipment. For example, it should be possible to quickly add a small high-pressure pump, an air compressor, more engine power, or any one of a number of items which may be used for only a portion of a well. This sort of thing is practical for any contractor who has two or more rigs. He stands a much better chance of keeping all his equipment busy at lower cost by being able to move it from rig to rig as it is needed.

Hydraulic system . . . Pumps presently in use have probably reached the maximum in power capacity, but design changes are just now beginning to show up that will make more efficient use of the many pounds of iron that contractors are forced to haul around. The V-type pump is a fairly radical departure that has much merit. With use its early drawbacks should be corrected and this general-type pump may well replace the heavier horizontal units now in use.

Drill-string design is far ahead of field practice. Drill tubing has been in use for a number of years by a few operators. When tool joints were used, excellent results were reported. Now, lightweight drill pipe is available in the popular sizes. High-strength drill pipe is available but handling methods are still developing. This problem will likely be solved in the near future.

While many rig owners have rushed to add larger pumps and engines to get better hydraulic conditions, few have gone to larger sizes of drill pipe. The effective hydraulic capacity of 5-in. drill pipe is approximately 30% greater than that of 4½-in. drill pipe. This means that a rig with 5-in. drill pipe and a 700-hp. pump is equivalent to another rig having 1½-in. drill pipe and a 1,000-hp. pump. A further gain of approximately 10% can be made by going to lightweight 5-in. drill pipe.

Maximum use of lightweight drill pipe can reduce costs in several ways: lower investments in pumps, engines, and hoists, and lower operating costs and maintenance.

Development of subsurface tools could lead to many changes in drilling equipment. The turbodrill, hammer drill, electric drill, sonic drill, and other down-the-hole motors could reduce horsepower needs for rotaries and strength requirements for drill pipe.

Better bits coming . . . One of our most pressing needs is for a bit of the conventional type that would stay in the hole longer at high loading. Such a bit could change handling equipment requirements.

Bearing life is rapidly becoming the controlling factor in bit life, not only in harder formations, but in the softer Gulf Coast drilling as well. As bit weights go up, as they must, bearing life will be even shorter. Lubrication is the answer. Addition of lubricants to drilling mud has been a help in extending bearing life in hard-rock drilling. Although experience is limited, there has been some definite improvement as drillers become accustomed to leaving bits in the hole longer.

The ultimate solution to this problem will be a sealed-bearing bit. These have been tried, but invariably the seal has failed before the bit wears out. Bearing life is usually extended, however, by the seal life. Time on bottom now runs 50 to 60% of total time on a well. Longer bit life can increase this percentage.

Drilling rates have doubled in the past 20 years. Most of the increase can be attributed to the use of jet bits. Further improvement in drilling rate and bit life is essential if contractors are to make a profit in the face of rising operating costs.

Other changes in order . . . Surface-equipment changes have been slow in the past. Little change has been made in mud handling, both liquid and dry, since the advent of steel mud pits. Suctions still sand up, valves fail to close off. Stirring has improved immensely on many larger rigs, but is still poor on most of the smaller ones. Very few rigs are arranged so pit volume can be tailored to fit hole size. Arrangement of pits shows little planning on a number of rigs. Volume measurement is often difficult.

Rig-floor equipment should show improvement, particularly in the form of automatic or semiautomatic pipe-handling equipment. Drill-collar handling particularly is very poor and time consuming. Rapid handling of large o.d. flush-joint sections might make fishing more attractive in some instances.

A tool to release stuck drill pipe, collars, and casing is imminent. Such a tool is now being field-tested. Should it prove practical much of the contractor's gamble will be covered.

The power swivel might well prove to be an aid in reducing connection time in the contractor's section of the hole. It probably will not be so valuable on land as on water.

"Rotaries and draw works have...almost reached the ultimate."

Rotaries and draw works have probably almost reached the ultimate, although drives for both can still stand much improvement. Here we are not looking particularly for greater dependability, but rather for greater adaptability. Standardization of drive components by a single contractor is a must. Shifting equipment from rig to rig as it is needed will reduce investment and at the same time improve the capabilities of individual rigs.

Some radical changes . . . The foregoing covers very briefly those items that are susceptible to normal evolution. But we could have a few radical changes. Atomic-powered engines would change our concept of drives completely. Ten-thousand-foot wells drilled with one or two bits! This could lead to drilling with casing and a need for a complete change in pipe-handling equipment. Some 5,000-ft. wells in Wyoming are now being drilled in this way.

Should a plastic material be developed to replace casing down the hole, hoisting requirements might be reduced.

New techniques or better application of those available might well reduce costs in both horsepower and manpower. Slim-hole drilling in some areas has done just that. Although slim-hole drilling has not been applied generally, a number of the improvements in equipment and techniques are the result of slim-hole work. It is reasonable to expect the same sort of thing from a number of other new techniques, such as air drilling and casingless completions.

J. K. Butler says . . .

THE MANPOWER QUESTION in our title does not in my opinion offer any great possibility of reduction. Round trips as we know them today require a minimum of four men regardless of the automatic devices available. With today's drilling rig we cannot, in my opinion, foresee a reduction in this area.

The large improvement which could be realized with manpower lies in the field of education and better working conditions. When and if it is possible to properly educate our drilling crews on the innumerable items about which they know nothing, we will reap the benefit of greatly reduced drilling time.

The greatest shortcoming in my opinion in the science of oil-well drilling lies in lack of transmission of intelligence to our working people. As wells increase in average depth and problems multiply, we will be forced to properly educate our roughnecks, drillers, and tool pushers. These men who work next to our problems could contribute immeasurably if their understanding of the problems were great enough to allow them to employ deductive reasoning. It has continued to amaze me that the philosophy of better education for our so-called educated people, which makes headlines in the U. S. A., should not be applied to our so-called uneducated people.

It is my opinion that we may not need a realignment of the manpower-horsepower situation to arrive at faster drilling rates; but we may need only a continued effort in the same direction which we have been headed for the last 2 or 3 years. Add to this, a program of better liaison between the management people and the working people and this problem may be solved.

What rigs do now . . . As a starting point for analyzing possible improvement, let us look at the existing situation. For purposes of this discussion, we are concerned with rigs capable of drilling between 9,000 and 11,000 ft. of 9⅝-in. or smaller hole, but not capable of drilling larger holes nor setting long strings of 9⅝-in. casing. Obviously any improvement in this drilling range could probably be applied to larger or smaller rigs as well. I have listed below some average times of our own operations and percentage breakdowns for wells in the discussion category. In my opinion, these are representative drilling times of at least average efficiency and from these breakdowns it is possible to draw certain conclusions.

It is obvious that the contractor's controllable time is almost entirely rotating time on bottom and drill-pipe trips. In studying the percentages applicable to spud to total-depth breakdown, we find rotating time on bottom plus trip time to be 81.4% of total time.

Trip time is a function of the horsepower for hoisting to a certain extent, but the main factor which increases trip-time percentage is number of bits run. An increase in horsepower for the draw works would probably not cut the actual trip time due to the mechanics of maintaining certain speeds when pipe is pulled from and lowered into open hole.

So, in order to reduce trip time, assuming a reasonable horsepower is available to the draw works, our real problem is reducing the number of trips. To lower the hours of rotating time on bottom, we are faced with the age-old problem of increasing penetration rates and being able to run bits longer at these increased penetration rates.

In summation, I firmly believe that although wells are being drilled much faster today, our main concern still lies in the application of the right bit for the right formation with proper hydraulics, weight, and rotary speed. I am very hopeful that this problem is being solved day by day.

Better bits today . . . In my opinion, the bits available to the contractor were not properly exploited until the last few years. Since that time, the average contractor has caught up with the technique which has been offered to him by the bit manufacturers. He has now improved his own technique to the point that further improvement will be possible due to bit research. All bit people are attempting to improve their product from day to day, but most of their discoveries must be run by efficient contractors in order to evaluate their true worth.

The oil business then, in my judgment, may look forward soon to the time when only half the bits will be required to drill a certain job as are required today. Taking the above tabulation into consideration, we then could expect to reduce the rotating time and trip time by half. If such were the case, we could make a 35 to 40% reduction in over-all time to drill any certain well. Certainly when that time arrives, the operator will be able to take a much cheaper look than he may at present.

Most efficient hydraulics . . . If we examine the horsepower available on the jobs from which the above tabulation was made, we find that an average of approximately 450 hydraulic horsepower was delivered to the standpipe. Our over-all average hydraulic horsepower delivered at the bit was approximately 275. The over-all average penetration rate was 36.2 ft. per hour.

An attempt was made while drilling these wells to maintain enough drill-collar weight to bury the teeth of whatever bit we had in the hole. This weight was varied with depth but we found in time that weight in excess of 40,000 lb. was unnecessary in the

"Our real problem is reducing the number of trips."

	Spud to T.D. (% of hours)	Spud to T.D. + comp. (% of hours)	Spud to T.D. + comp. + move & rig up (% of hours)
Tear down, move and rig down	...	...	9.3%
Rotating time on bottom	69.8%	54.4%	49.2%
Survey	2.2%	1.7%	1.5%
Condition mud	...	2.0%	2.0%
Lubricate rig	6.0%	5.2%	4.8%
Run surface casing	0.9%	0.7%	0.6%
WOC surface casing	6.2%	4.8%	4.3%
Trips	11.6%	11.4%	10.3%
Lay down drill pipe	...	1.4%	1.2%
Log	...	2.2%	2.0%
Completing	...	13.7%	12.5%
Repair rig	1.3%	1.0%	0.9%
Misc.	2.0%	1.5%	1.4%

area in which we operated. Average rotary speed for the soft top portion of hole was 120 to 150 r.p.m.

Average jet velocity was approximately 350 ft. per second, and the average return annulus was approximately 140 ft. per minute. To properly evaluate jet velocity and return-annulus conditions, we have experimented on larger rigs and, in our opinion, a jet velocity in excess of 400 ft. per second offers no economic return when applied to the bits available today.

Regardless of any calculus formula to the contrary, the continued application of increased jet velocity, increased weight, increased rotary speed, and increased return annulus does not increase the penetration rate indefinitely. We are hopeful that eventually we will know more about the actual conditions at the bottom of the hole in present-day drilling. When and if such knowledge is gained, we see no reason why bit design could not be affected and from that a bit made available which would exploit greater horsepower.

For proper handling of horsepower, there are several methods available that are a great aid in exploiting our situation. We are at present experimenting with a string of 4½-in. N-80 tubing equipped with tool joints. This pipe extends a drilling rig in both the application of hydraulic horsepower and the speed of hoisting.

The rig which now uses this pipe is able to deliver approximately 50 more horsepower to the bit at 10,000 ft. than would be available if 4½-in. drill pipe were used. At 10,000 ft., the drill string weighs approximately 40,000 lbs. less than would a comparable drill-pipe string. We feel that in effect this pipe adds approximately 150 to 200 gross hp. to our rig in its original state.

Well-planned mud programs also may increase the usable horsepower in any drilling rig. Maintaining a reasonable-weight mud rather than an arbitrary higher weight makes available to the bit as much as 5 to 10% more horsepower.

Other places we can save . . . To go back for a moment to the above tabulation, I would like to point out to the operators that our average survey time on these jobs shows 2.2% of the total time between spud and total depth. We feel that our equipment available for surveying is reasonably efficient and we use dropping survey instruments on trips where possible.

It has occurred to me that the operator in noncritical areas makes no real use of these surveys. If he realized that 2% of an average 400-hour job was used in making them, he might wish to look into the situation. This represents 8 full hours or a full crew tour that could be used in a much more productive manner. Certainly the above statement does not apply to salt-dome drilling where deviations are of a critical nature.

We also notice that cement time is still required in probably a majority of the operating procedures. By cement time I refer to that waiting time over and above the time required for installing the blowout preventers. This time varies from 12 to 36 hours and is, of course, nonproductive. It has occurred to me that if the operator were to apply the same pressure to the cement manufacturers that the drilling contractor is subjected to, then this situation could be improved.

Lubrication takes time . . . You will notice in the tabulation that the average time required to lubricate the rig is approximately 6% from spud to total depth. This situation has been a concern to us as contractors inasmuch as we consider it controllable time. Certainly it is a very necessary operation but it could stand study and possibly improvement by rig-equipment manufacturers.

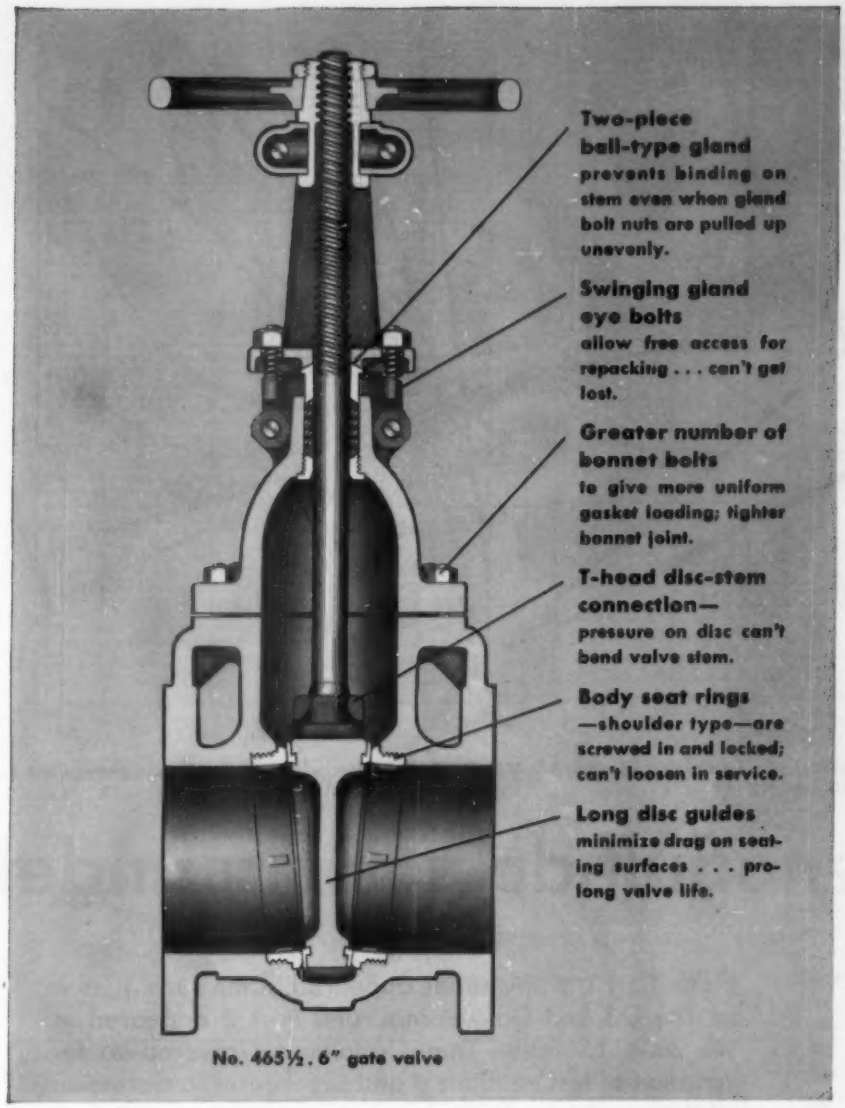
I have often wondered why central automatic systems are not installed on our present draw works and pumps. Certainly it would effect a reasonable payout. Going back to the average 400-hour job, we find approximately 16 hours used in lubricating the machinery. Assuming an average penetration rate of 36 ft. per hour, we come up with 576 ft. lost by lubricating the rig.

Horsepower too heavy . . . Before leaving our discussion of horsepower, there are several thoughts that I would like to leave with you. To make a real improvement in our present-day mechanized rig, some means of cheaper horsepower has to be discovered. There is no real difference in the horsepower-to-weight ratio of present engines and the engines which were available to the industry approximately 18 years ago when I first entered the drilling business. We have, during that period of time, in my opinion, seen great improvement in clutches, transmissions, pump gear ends, etc. But we have had scarcely any engineering help from our friends, the engine manufacturers.

The availability of horsepower at a lower weight ratio would do more for the drilling business as we know it today than any other improvement. It would affect our transportation cost and it would affect our rigging-up and tearing-down time. It probably would affect our capital-investment problem to the extent that larger horsepower requirements would be met and some economic sense could be made out of the general pattern.

General efficiency of equipment and wearing parts has been improved by the manufacturers. Certainly, present-day wire lines, when exploited in the proper manner, are good. Performance of crown blocks, traveling blocks, swivels, rotaries, power-transmission equipment, etc. leaves nothing to be desired considering the conditions under which it is used and moved.

Modern portable derricks are certainly efficient. Whether or not these people are able in the future to use lighter metals remains to be seen. Certainly attempts are being made to decrease the weight in most drilling-rig materials.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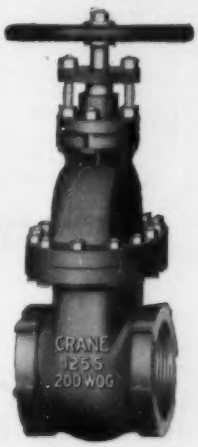

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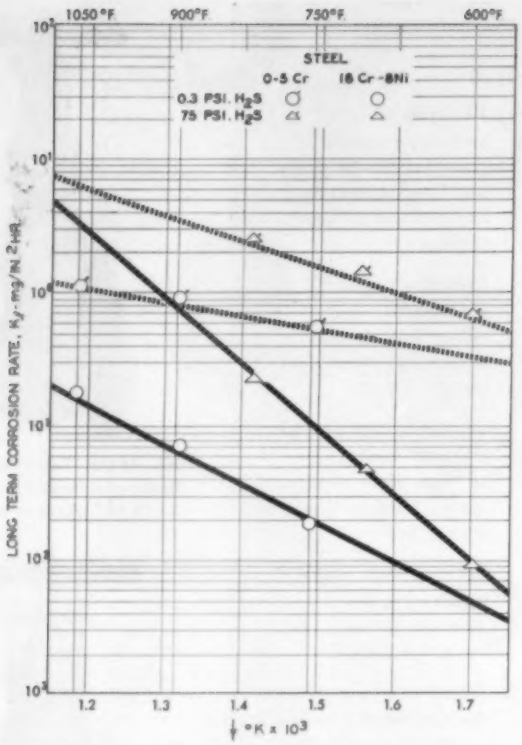
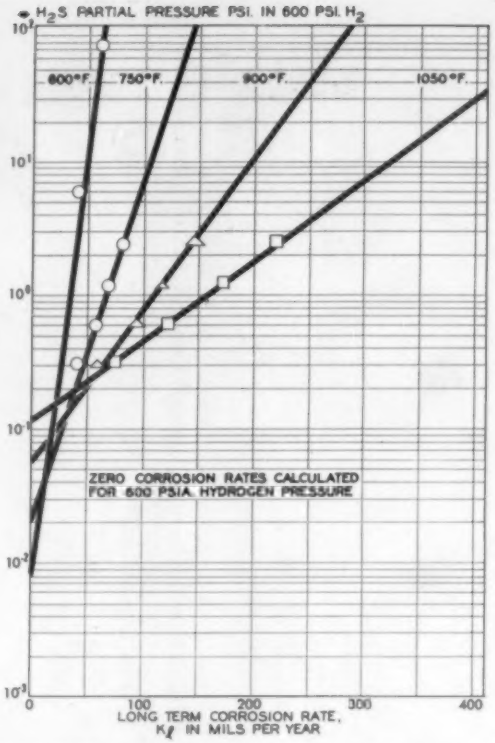


CORROSION-RATE CONSTANT, K_l, being plotted according to the Arrhenius equation. Fig. 13.



VALUES OF K_l at various temperatures plotted against hydrogen sulfide pressure. Fig. 14.

Sulfide scaling under

PART 3 OF 3 PARTS

Note: Part 1 of this series appeared in the June 1 issue of The Oil and Gas Journal, and Part 2 appeared in the June 15 issue. These installments covered a description of test equipment and procedures, a discussion of the process variables, and corrosion by organic sulfides. This present installment is devoted to the prediction of long-term corrosion rates.

BY W. H. SHARP AND E. W. HAYCOCK
Shell Development Co.

ALTHOUGH short sulfiding runs serve useful purposes, such as outlining effects of variables on corrosion rates, it is the long-term rates that are of greatest practical interest. The effect of exposure time on corrosion rate can be seen by referring to Fig. 4 which shows the curve for corrosion rate versus time to be very steep for the first week and still declining appreciably after 3 weeks (500 hours).

It is clear that corrosion-rate predictions from short-term experiments can be misleading. To minimize extrapolation errors, a kinetic analysis was used to predict long-term rates.

The scaling process has been shown[3] to follow the equation:

$$x = \frac{K_p}{K_l} \ln \frac{K_p}{K_p - K_l (x - K_l t)} \quad (1)$$

Where:

x = metal consumed in time t.
K_p, K_l = rate constants.

Paper presented at API Division of Refining midyear meeting, New York, May 27, 1959.

The weight loss-time curve approaches a straight line which characterizes long-term operation for that particular set of conditions. The equation for the line is:

$$K_p - K_l (x - K_l t) = 0 \quad (2)$$

The gradient of this line, which is the long-term corrosion rate, is equal to K_l.

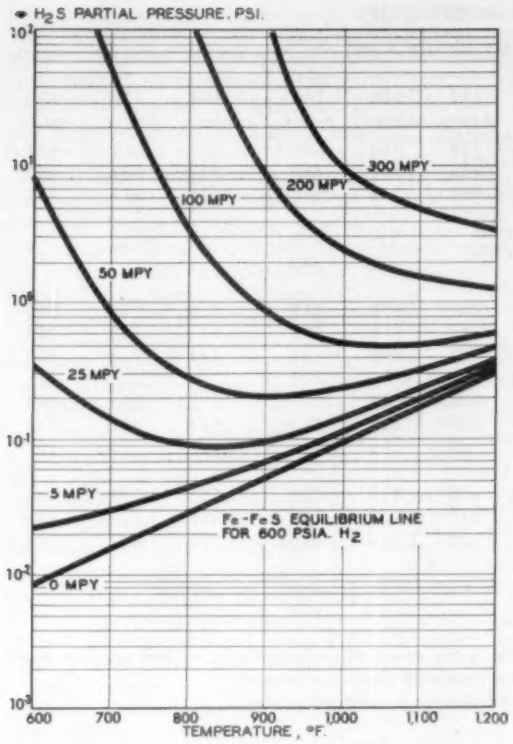
Values of K_l were determined for each experimental condition from weight-loss data for 100 to 500-hour exposure periods. (See Tables 6A, 6B, and 6C.) K_l values thus obtained were plotted according to the Arrhenius equation (see Fig. 13):

$$K_l = Ae^{-E/RT} \quad (3)$$

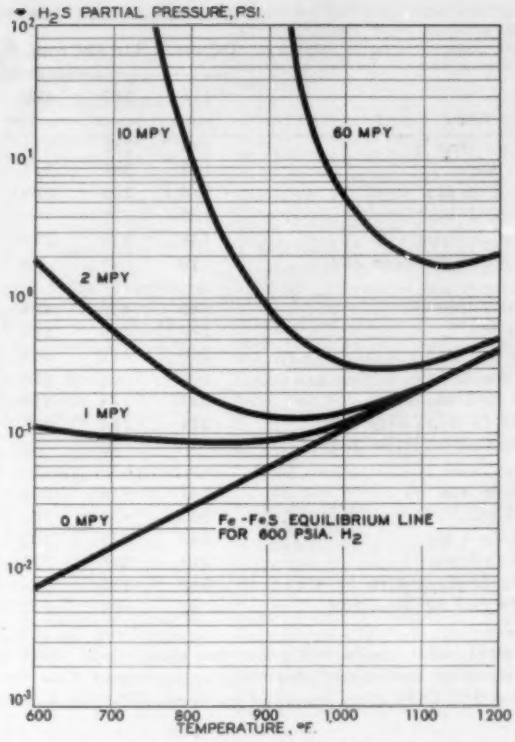
Where:

A = frequency factor.
E = energy of activation.
R = gas constant.
T = absolute temperature.

This allowed smoothing of experimental points based on the assump-



ISOCORROSION CURVES for low-chromium (0 to 9 Cr) steels. Fig. 15.



ISOCORROSION CURVES for 18 Cr-8 Ni steel. Fig. 16.

hydrorefining conditions

TABLE 6A—SULFIDE SCALING WEIGHT LOSSES*

Temp. (°F.)	Alloy	0.6 psi. H_2S in 600 psig. H_2 15 hours	20 hours	25 hours	68 hours	75 hours	115 hours	193 hours	226 hours	312 hours	485 hours
750	Pure iron (A)	...	43	...	85	...	...	...	243	...	...
	Pure iron (F)	...	...	...	...	...	186	...	...	320	457
	½ Mo	55	69	65	165	303	206	315	286	322	473
	5 Cr-½ Mo	46	52	64	105	221	202	234	228	313	475
	9 Cr-1 Mo	29	...	44	...	226	...	200	97	275	439
	12 Cr (Type 410)	33	27	26	...	...	...	123	29	161	423
	18 Cr-8 Ni (Type 304)	4.2	...	1.3	...	...	...	7.9	4.7	21	36
900	Pure iron A	81	102	89	188	...	...	407	394	...	...
	Pure iron (F)	...	...	...	...	...	363	...	...	586	722
	½ Mo	116	141	142	234	332	433	531	577	682	902
	5 Cr-½ Mo	102	125	109	263	272	376	389	518	600	703
	9 Cr-1 Mo	91	108	63	218	248	357	360	423	491	680
	12 Cr (Type 410)	108	...	32	155	...	344	246	271	394	593
	18 Cc-8 Ni (Type 304)	10	...	5.6	16	...	37	23	...	48	97
1,050	Pure iron (A)	...	169	...	362	...	...	...	723	...	...
	Pure iron (F)	...	...	...	...	...	618	...	...	938	1,237
	½ Mo	200	203	148	458	322	630	700	853	1,020	1,270
	5 Cr-½ Mo	152	205	207	428	285	610	762	770	988	1,275
	9 Cr-1 Mo	106	...	134	...	102	...	565	724	915	1,200
	12 Cr (Type 410)	103	...	...	...	...	...	610	318	839	1,045
	18 Cr-8 Ni	7.5	14	5.6	...	...	...	55	80	133	149

*Weight losses are in milligrams per square inch. Each value is the result of measurements on one or more specimens exposed to continuous, essentially uninterrupted flow for the indicated exposure period.

TABLE 6B—SULFIDE SCALING WEIGHT LOSSES*

Temp. (°F.)	Alloy	0.3 psi. H_2S in 600 psig. H_2 116 hours	258 hours	400 hours	1.2 psi. H_2S in 600 psig. H_2 115 hours	230 hours	330 hours	2.4 psi. H_2S in 600 psig. H_2 108 hours	176 hours	294 hours
750	Pure iron (F)	144	252	317	228	322	402	210	250	422
	½ Mo	163	261	341	255	363	465	275	352	423
	5 Cr-½ Mo	149	252	278	222	343	505	294	335	448
	9 Cr-1 Mo	138	231	199	...	...	...	...	...	...
	12 Cr (Type 410)	138	211	249	...	...	412	...	...	...
	18 Cr-8 Ni (Type 304)	10	21	18	...	...	42	...	...	...
900	Pure iron (F)	246	408	464	460	609	818	525	650	796
	½ Mo	297	440	587	484	713	978	631	703	1,002
	5 Cr-½ Mo	250	429	568	407	696	885	644	708	933
	Pure Cr-Fe†	...	...	496	...	...	719	...	...	...
	9 Cr-1 Mo	231	374	516	374	561	735	573	525	693
	12 Cr (Type 410)	221	334	447	350	485	593	542	429	544
	18 Cc-8 Ni (Type 304)	10	20	37	47	73	113	68	69	120
1,050	Pure iron (F)	141	578	603	420	1,039	1,700	1,386	1,308	1,846
	½ Mo	303	633	780	677	1,277	1,760	1,369	1,429	1,890
	5 Cr-½ Mo	386	731	762	840	1,364	1,890	1,382	1,422	1,975
	9 Cr-1 Mo	414	545	733	...	...	...	...	...	...
	12 Cr (Type 410)	350	512	584	...	...	1,295	...	...	...
	18 Cr-8 Ni (Type 304)	43	91	112	...	...	374	...	...	...

*Weight losses are in milligrams per square inch. Each value is the result of measurements on one or more specimens exposed to continuous, essentially uninterrupted flow for the indicated exposure period.

†Pure 5% Cr-Fe alloy prepared by vacuum-melting electrolytic chromium with pure iron.

TABLE 6C—SULFIDE SCALING WEIGHT LOSSES*

Temp. (°F.)	Alloy	6 psi. H_2S in 600 psi. H_2		30 psi. H_2S in 600 psi. H_2		75 psi. H_2S in 600 psi. H_2			150 psi. H_2S in 600 psi. H_2	
800	Pure iron (F)	325	645	457	681	593	...	955	592	962
	5 Cr-½ Mo	341	707	553	833	713	957	1-120-1,100	690	1,078
	9 Cr-1 Mo	315	675	545	833	69	925	923	646	1,000
	12 Cr	255	643	...	689	640	...	588	534	700
	18 Cr-8 Ni	14.7	76.9	57	88	57	88	105	62	91
700	Pure iron (F)	162	298	172	286	230	365	441-452	248	354
	5 Cr-½ Mo	182	327	233	375	294	384	573-546	243	417
	9 Cr-1 Mo	162	337	237	384	295	417	491-426	254	370
	12 Cr	125	282	212	315	250	308	432	219	366
	18 Cr-8 Ni	9.8	26.1	21	35	23	36	51	27	34
600	Pure iron (F)	47.5	89.8	43	121	76	85	156	71	102
	5 Cr-½ Mo	60.0	126	69	129	101	130	168	88	155
	9 Cr-1 Mo	50.0	124	95	158	111	149	217	97	154
	12 Cr	34.5	95.4	79	108	95	119	149	97	130
	18 Cr-8 Ni	1.6	3.6	3.5	8.4	7.4	10	9	65	8.7

*Weight losses are in milligrams per square inch. Each value is the result of measurements on one or more specimens exposed to continuous, essentially uninterrupted flow for the indicated exposure period.

tion that a plot of K_1 against 1/T should give a straight line. The smoother values of K_1 for temperatures of 600°, 750°, 900°, and 1,050° F. were then plotted against hydrogen sulfide pressure on semilog paper (see Fig. 14). The lines connecting these experimental points were then extended to the values of hydrogen sulfide partial pressures calculated from thermodynamic data for equilibrium (zero rate) conditions for iron in 600-psia. hydrogen.

Long-term rates . . . Plots of the type shown in Fig. 14 were then used as a source of long-term corrosion rates or K_1 values which were replotted against temperature. These values plus the equilibrium line for the system $Fe + H_2S = FeS + H_2$, at a hydrogen pressure of 600 psia. comprise the family of isocorrosion curves shown in Fig. 15 for low-chromium (0 to 9 Cr) steels and Fig. 16 for 18 Cr-8 Ni steel.

Small improvements in corrosion resistance of 12 Cr over 0 to 9 Cr steels did not justify a separate set of curves. Note that the position of the equilibrium line is determined by a definite hydrogen pressure, in this case 600 psia.; in general, the isocorrosion curves are not. Below the equilibrium line iron is stable; above it iron sulfide is stable.

For higher hydrogen pressure successively higher equilibrium lines (hydrogen sulfide pressures) are in effect because the H_2S/H_2 equilibrium ratio

is constant for a given temperature. The isocorrosion curves designate rates of reaction above the equilibrium line; theoretically their placement is determined by temperature and by hydrogen sulfide pressure and not by hydrogen pressure.

Data obtained during the present investigation confirm that there is no effect of hydrogen pressure over a wide range (60 psia. to 600 psia.) For this reason, it appears that plots of corrosion data against hydrogen sulfide pressure are preferable to those against concentration. Application of the latter data to units operating at widely different pressures could lead to appreciable errors.

A limited number of corrosion data available for Platforming conditions fit the curves of Figs. 15 and 16 well. Hydrodesulfurizer corrosion rates are predicted considerably less accurately. Predictions are only slightly high for a hydrodesulfurizer operating under high hydrogen sulfide pressure but, for units operating under less corrosive conditions, predicted rates are three to four times those from the hydrodesulfurizers.

Recent publications,[8,9] indicate other attempts to predict corrosion rates in the hydrodesulfurizer range have encountered this same difficulty. Available data indicate hydrodesulfurizer rates cannot all be fitted by a general correlation, that some as yet unknown factors reduce plant sulfiding rates considerably below those for a hydrogen sulfide-hydrogen system.

This is emphasized by several unusual instances in which hydrodesulfurizer corrosion rates at the reactor inlet have been found to be as much as twice those at the outlet, although the outlet hydrogen sulfide partial pressure was twice as high and the temperatures equal. All plant data compared with Figs. 15 and 16 have been equal to, or less than, the predicted values. Plant data for 12 Cr steels are somewhat erratic and usually considerably below those predicted for 0 to 9 Cr steels.

An interesting point may be observed by inspection of one of the preliminary plots from which the isocorrosion curves were produced. Fig. 13 shows that curves produced by plotting corrosion rates of 18 Cr-8 Ni steel against the reciprocals of the absolute temperature have steeper gradients than similar curves from low chromium steels. Extrapolation of the plots indicates that, at high hydrogen sulfide partial pressures and temperatures, corrosion rates of stainless steel will exceed those of low chromium steels. At low hydrogen sulfide pressures the advantage of 18 Cr-8 Ni steels should extend to very high temperatures.

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BOOKS

SUMMARY OF SECONDARY RECOVERY OPERATIONS IN KANSAS DURING 1957. Prepared by Kansas Secondary Recovery Committee, Dr. Charles F. Weinaug, chairman. Published by Interstate Oil Compact Commission, Box 3127, Oklahoma City.

This report contains information previously published in Bulletin 133, State Geological Survey of Kansas, 1958. Data in 212 projects located in Kansas are included, together with a map of eastern Kansas producing areas as of December 31, 1957.

During 1957, it is estimated that 16,900,000 bbl. were produced from these secondary-recovery operations. Greenwood County led all other counties in Kansas with more than 5,870,000 bbl. Butler County produced in excess of 4,000,000 bbl. of secondary recovery oil during 1957. These two counties accounted for more than half the oil produced through water flooding in Kansas, and a total of eight counties produced in excess of 50% of the total produced by this method.

DETERMINATION OF THE FLOWING AND STATIC BOTTOM-HOLE PRESSURES OF NATURAL GAS WELLS. By Paul B. Crawford and George Fancher. Published by Texas Petroleum Research Committee, University of Texas, Austin. $5.00.

This method and manual of procedure developed by the TPRC facilitates determination of performance and potential of gas wells. An important item in such determinations is calculation of static and bottomhole pressure from surface observations. The TPRC method not only increases accuracy and ease of making such computations but also greatly increases reliability of the computations with the result that they can be readily checked, errors found, and discrepancies ascertained.

TPRC Bulletin 72 contains 142 graphs, figures, and charts, the uses of which are explained briefly and clearly by examples worked out.

The Railroad Commission of Texas has authorized the use of the TPRC method in the adjustment of the absolute open-flow for determination of the potential of gas wells required by state-wide Rule 24 and the submission of Form GWT-4. The bulletin is also authorized for use in conjunction with the manual of the standard "Back Pressure Test for Natural Gas Wells for the State of Texas."

THE GREATEST GAMBLERS, by Ruth Sheldon Knowles. Published by McGraw-Hill Book Co., Inc., 330 West Forty-second Street, New York 36. 347 pages. $6.

This oil history centers around oil personalities, and is written in nontechnical language for both oil men and the general public. It begins with the discovery of commercial oil by Drake and ends with a description of the fast-paced oil boom which hit Green County, Kentucky, last year.

Times to be released on the opening day of the International Oil Exposition, the book is a lively discussion of the motives and methods of oilmen during the last century, and tells of such personalities as Edward Doheny, Charles Canfield, Everette DeGolyer, Mike Benedum, Tom Slick, Harry Sinclair, H. L. Hunt, and Dad Joiner.

ALASKA PETROLEUM DIRECTORY. Edited by Bob Kederick. Published by Petroleum Publications, Inc., 427 G Street, Anchorage, Alaska. 96 pp. $7.50.

This is the forty-ninth state's first oil and gas-industry guide. It has four working sections, beginning with a listing of individual leaseholders and applicants in Alaska, as filed at the Anchorage, Fairbanks, and Juneau land offices.

A second section deals with operating and land companies. This includes a listing of all firms with Alaska offices, and also nonresident firms active in Alaska.

A third section of the directory discusses government agencies, including territorial, federal and miscellaneous agencies, and leasing regulations.

The fourth section lists services, supplies, consultants, brokers, and transportation information.

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DST—SUCCESS OR FAILURE?

. . . Which it is may largely depend on your ability to differentiate between formation water and mud filtrate.

AS THE RATE of exploration for new producing horizons increases, and the stage of exploratory activity becomes older with time, we find ourselves exploring for thinner and dirtier (shalier) reservoirs. With this advancing rate and stage, the ratio of conclusive to nonconclusive drill-stem tests continuously decreases. A conclusive drill-stem test may be defined as one in which the fluid recovery consists of a continuous flow of gas, oil, or formation water with a substantial fill up in the pipe to indicate the well productivity. These are rather rare today.

The nonconclusive-type drill-stem tests are very common, and a statistical study to establish the ratio of conclusive to nonconclusive tests might result in questioning the feasibility of running a drill-stem test at all in many areas. It might be decided that a drill-stem test is nonconclusive in case of (a) a packer failure, (b) testing of a wrong interval such as a nonfractured shale section, (c) testing of a large in-

The author says . . .

With the ever-increasing difficulty in the discovery of oil reserves within the United States today, it is important to completely and conclusively evaluate every possible productive reservoir. The nature of an oil operator is such, that when he observes a recovery of only the slightest amount of water, he immediately condemns the reservoir and with it the well if no additional prospects occur. A watchful and rational approach in evaluating drill-stem, formation-fluid sampler, and production-test data, would eliminate the bypassing of commercial hydrocarbon reservoirs from which water, that is really mud filtrate, is recovered. In view of the past lackadaisical evaluation of test results and data, it is believed that numerous commercial fields have been bypassed.

BY JACK GRYNBERG
Jack Grynberg & Associates, Denver

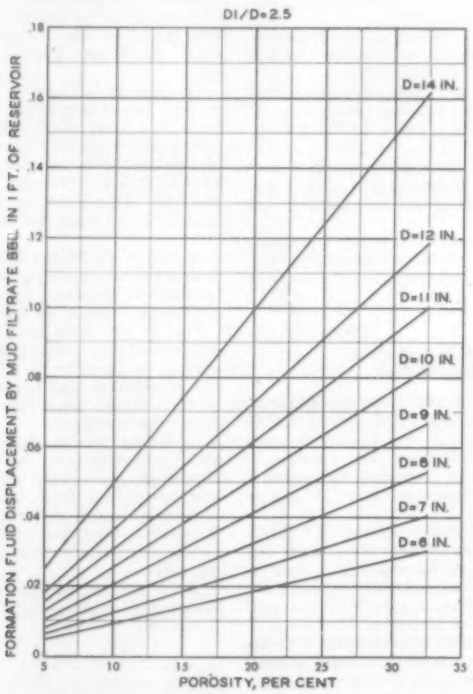

Fig. 1.

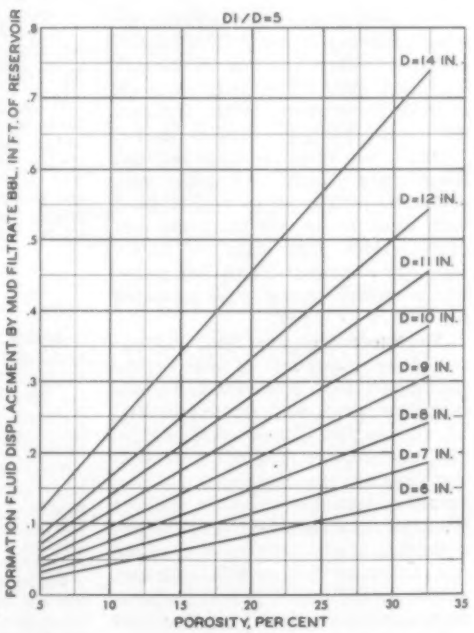

Fig. 2.

THESE GRAPHS give the quantity of formation fluid displaced by mud filtrate in 1 ft.

terval of several hundred feet, especially when it includes numerous reservoirs of various pressures, (d) test where the tool is open an insufficient amount of time, (e) no fluid recovery or a recovery of some mud, possibly gas cut, oil cut or water cut, (f) a recovery of small amounts of oil or gas, (g) a recovery of oil or gas and water, where the hydrocarbon (oil and/or gas) portion is equal to or less than approximately 60% of total fluid recovery, (h) a recovery of small to relatively large amounts of either clear or muddy water.

Formation sampler . . . In case of a formation-fluid sampler the conditions would be similar though on a smaller scale since the fluid sampler is limited by a capacity of 5 gal. Also the penetration and drainage range of the jet does not exceed two hole diameters or approximately 10 in. from the bore face. The formation fluid sampler would drain the fluid in a reservoir from behind a permeability block, if a permeability block exists, but it is definitely limited by the mud-filtrate invasion diameter and quantity of fluid recovery.

Reservoir Characteristics

Conclusive drill-stem tests are usually a product of clean, thick, porous and permeable reservoirs, with sufficient pressure, where small or moderate mud-filtrate invasion exists, and where a permeability block is nonexistent or only partial.

Nonconclusive drill-stem tests are generally a product of thin to medium-thick reservoirs, deeply invaded reservoirs, low-pressure reservoirs, low-permeability reservoirs, and reservoirs filled with colloidal particles such as clay, shale, bentonite, etc., which are generally known as dirty reservoirs. In the last type of reservoir a complete permeability block, a partial permeability block, or a preferential permeability block may occur when all of the colloidal particles swell upon being brought in contact with mud filtrate in the invaded zone. Thus, no original formation fluid can be recovered unless the permeability block is penetrated by a fluid sampler, by fracturing, or by some other hydraulic artificial well stimulation. A partial permeability block exists when only a portion of the colloidal particles are swelled, and a preferential permeability block exists when only certain colloidal particles swell, blocking the flow of oil while allowing the less viscous mud filtrate and/or mobile interstitial water to be recovered on a drill-stem test.

When analyzing cores from water, gas, gas distillate, and high gravity-low viscosity oil reservoirs, the original formation fluid, with the exception of the irreducible water saturation, could be 100% flushed and displaced by mud filtrate. A similar condition is present in the invaded zone nearest to the bore face and could extend laterally depending on the magnitude of flushing and effectiveness of displacement. In oil-bearing reservoirs all of the mobile formation fluid would be displaced by the invading mud filtrate, leaving only the irreducible water and the residual oil. The shalier the reservoir, the higher is the irreducible water saturation, IWS, which is a direct function

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Grynberg

Jack Grynberg is owner of Jack Grynberg & Associates, consulting petroleum and geophysical engineers, Denver. He is a graduate of Colorado School of Mines, with degrees in petroleum production engineering, petroleum refining engineering, and is completing work in geophysical engineering. He worked as a research engineer in the research and development department of Continental Oil Co., Ponca City. Together with Dr. S. J. Pirson, of University of Texas, he has been conducting 2-week logging schools throughout the United States, Europe, and the Middle East.

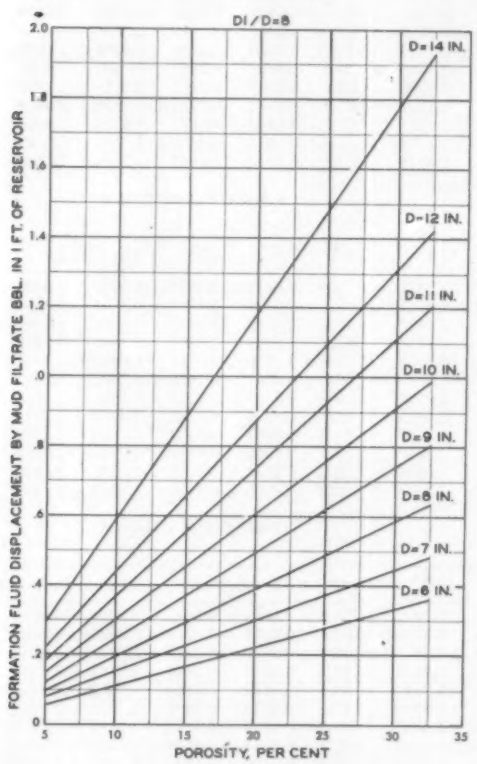


Fig. 3.

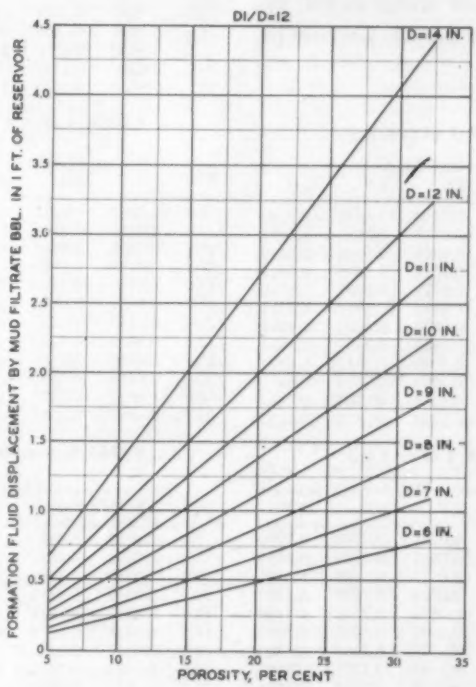


Fig. 4.

of reservoir for various hole diameters, porosities, and invasion diameters.

of water saturation in the invaded zone, $(S_w)_i$, and may be expressed as $IWS = (S_w)_i^n$, where "n" varies from 1.0 to 4.0 with a most frequent average of 2.5. The IWS and $(S_w)_i$ values are expressed as fractions or percentages of pore space. Interpreting the above relationship, it is seen that in a reservoir devoid of fine colloidal particles the irreducible water saturation is lower and the invasion in this zone is lower, thus allowing a higher residual-oil saturation in oil-bearing reservoirs. Contrary to common belief, low-permeability reservoirs undergo deeper mud-filtrate invasion and larger formation-fluid displacement than higher-permeability reservoirs because of the capillary-displacement principle.

Permeability block . . . To establish the presence of an effective or partially effective permeability block through a direct method is impossible. However, some extrapolative thinking would aid in establishing the probability of its existence. If it can be determined that a given reservoir is shaley, and the mud used in drilling the well has a water loss greater than 3 cc. per 30 minutes, then a likelihood exists that a permeability block is present in a given reservoir. The shaliness can sometimes be determined from well cuttings, but it is more accurate to establish this from the spontaneous potential. When analyzing a reservoir in a well, compare its spontaneous potential (S.P.) deflection with other reservoirs, preferably of the same geologic age. If after making appropriate S.P. bed-thickness corrections, the S.P. deflection in the reservoir under consideration is still reduced, it may be concluded that the subject reservoir is shaley. The amount of shaliness increases with the reduction of the negative S.P. deflection. The above would not solve the problem where all reservoirs within one geologic age are shaley, where only one reservoir is present, or where there is zero or positive S.P. deflection. There, the knowledge of formation-water resistivity is necessary with the aid of which the theoretical S.P. deflection can be calculated and compared with the recorded one. If the latter is reduced, then the subject reservoir is shaley.

No permeability block . . . The main purpose of this paper, however, is to deal with reservoirs where no or partial permeability block is present, but the fluid recovery on a drill-stem test is nonconclusive. An attempt is made to estimate the amount of mud filtrate displacing the original formation fluids in the invaded zone for reservoirs whose parameters can be determined by other means. Assuming that all or the majority of the mobile fluids have been displaced during drilling operations, the mud filtrate from the invaded zone would be the first fluid to be recovered on a drill-stem test. This recovered fluid does not have to be muddy; as a matter of fact in most cases it is very

THESE TABLES contain the same data as the curves in Figs. 1 through 4, but are set up with different parameters, and can be read more accurately. The numbers in the body of the tables are formation fluid displaced by mud filtrate in barrels per foot of reservoir.

TABLE 1 (d = 6 in.)

P%	Di/d 2.5	5.0	8.0	12.0
5.0	0.0046	0.0210	0.0551	0.1249
7.5	0.0068	0.0315	0.0826	0.1874
10.0	0.0092	0.0419	0.1101	0.2499
12.5	0.0115	0.0524	0.1376	0.3124
15.0	0.0138	0.0629	0.1651	0.3748
17.5	0.0161	0.0734	0.1927	0.4373
20.0	0.0184	0.0839	0.2202	0.4998
22.5	0.0206	0.0944	0.2477	0.5623
25.0	0.0229	0.1049	0.2752	0.6247
27.5	0.0252	0.1153	0.3028	0.6872
30.0	0.0275	0.1258	0.3303	0.7497
32.5	0.0298	0.1363	0.3578	0.8122

TABLE 2 (d = 7 in.)

P%	Di/d 2.5	5.0	8.0	12.0
5.0	0.0062	0.0285	0.0749	0.1700
7.5	0.0094	0.0428	0.1124	0.2551
10.0	0.0125	0.0571	0.1499	0.3401
12.5	0.0156	0.0714	0.1873	0.4252
15.0	0.0187	0.0856	0.2248	0.5102
17.5	0.0219	0.0999	0.2622	0.5952
20.0	0.0250	0.1142	0.2997	0.6803
22.5	0.0281	0.1285	0.3372	0.7653
25.0	0.0312	0.1428	0.3746	0.8504
27.5	0.0343	0.1570	0.4121	0.9354
30.0	0.0375	0.1713	0.4496	1.0204
32.5	0.0406	0.1855	0.4868	1.1054

TABLE 3 (d = 8 in.)

P%	Di/d 2.5	5.0	8.0	12.0
5.0	0.0082	0.0373	0.0979	0.2221
7.5	0.0122	0.0559	0.1468	0.3332
10.0	0.0163	0.0746	0.1957	0.4443
12.5	0.0204	0.0932	0.2447	0.5553
15.0	0.0245	0.1118	0.2936	0.6664
17.5	0.0285	0.1305	0.3425	0.7775
20.0	0.0326	0.1491	0.3916	0.8885
22.5	0.0367	0.1678	0.4404	0.9996
25.0	0.0408	0.1864	0.4893	0.1107
27.5	0.0449	0.2050	0.5382	1.2217
30.0	0.0489	0.2237	0.5872	1,3328
32.5	0.0530	0.2423	0.6361	1.4439

TABLE 4 (d = 9 in.)

P%	Di/d 2.5	5.0	8.0	12.0
5.0	0.0103	0.0472	0.1238	0.2811
7.5	0.0155	0.0708	0.1858	0.4217
10.0	0.0206	0.0944	0.2477	0.5623
12.5	0.0258	0.1180	0.3096	0.7028
15.0	0.0310	0.1416	0.3716	0.8434
17.5	0.0361	0.1651	0.4335	0.9840
20.0	0.0413	0.1887	0.4954	1.1245
22.5	0.0464	0.2123	0.5573	1.2651
25.0	0.0516	0.2359	0.6193	1.4057
27.5	0.0568	0.2595	0.6812	1.5463
30.0	0.0619	0.2831	0.7430	1.6868
32.5	0.0671	0.3067	0.8050	1.8274

TABLE 5 (d = 10 in.)

P%	Di/d 2.5	5.0	8.0	12.0
5.0	0.0127	0.0583	0.1529	0.3471
7.5	0.0191	0.0874	0.2294	0.5206
10.0	0.0255	0.1165	0.3058	0.6942
12.5	0.0319	0.1456	0.3823	0.8677
15.0	0.0382	0.1748	0.4587	1.0412
17.5	0.0446	0.2039	0.5352	1.2148
20.0	0.0510	0.2330	0.6116	1.3883
22.5	0.0573	0.2621	0.6881	1.5619
25.0	0.0637	0.2913	0.7646	1.7354
27.5	0.0701	0.3204	0.8410	1.9090
30.0	0.0765	0.3495	0.9175	2.0825
32.5	0.0828	0.3786	0.9939	2.2560

TABLE 6 (d = 11 in.)

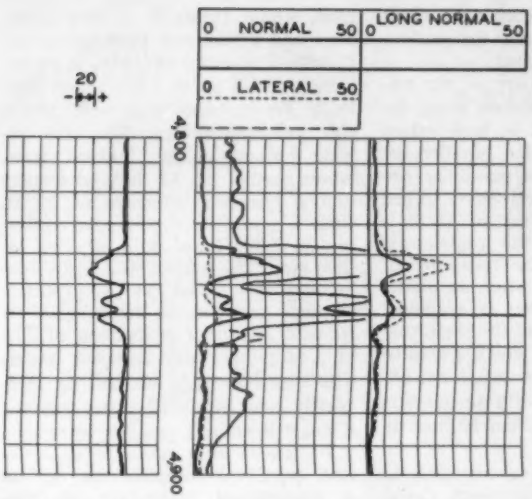
P%	Di/d 2.5	5.0	8.0	12.0
5.0	0.0154	0.0705	0.1850	0.4200
7.5	0.0231	0.1057	0.2775	0.6300
10.0	0.0308	0.1410	0.3700	0.8399
12.5	0.0385	0.1762	0.4625	1.0499
15.0	0.0463	0.2116	0.5551	1.2599
17.5	0.0540	0.2467	0.6476	1.4699
20.0	0.0617	0.2819	0.7401	1.6799
22.5	0.0694	0.3172	0.8326	1.8899
25.0	0.0771	0.3524	0.9251	2.0999
27.5	0.0848	0.3877	1.0176	2.3098
30.0	0.0925	0.4229	1.1101	2.5198
32.5	0.1002	0.4582	1.2026	2.7299

TABLE 7 (d = 12 in.)

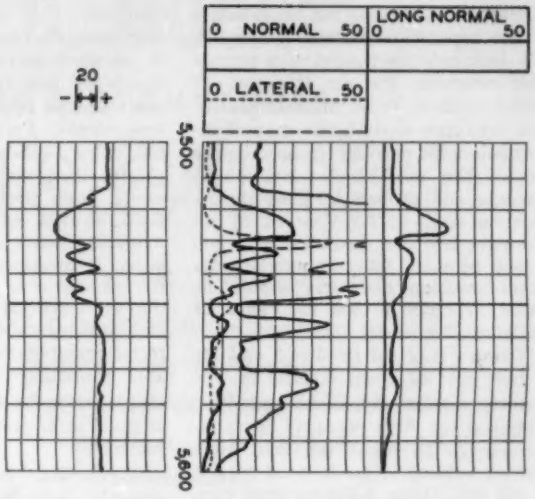
P%	Di/d 2.5	5.0	8.0	12.0
5.0	0.0183	0.0839	0.2202	0.4998
7.5	0.0275	0.1258	0.3303	0.7497
10.0	0.0367	0.1678	0.4404	0.9996
12.5	0.0459	0.2097	0.5505	1.2495
15.0	0.0550	0.2516	0.6606	1.4994
17.5	0.0642	0.2936	0.7707	1.7493
20.0	0.0734	0.3355	0.8808	1.9992
22.5	0.0826	0.3775	0.9909	2.2491
25.0	0.0917	0.4194	1.1010	2.4990
27.5	0.1009	0.4614	1.2110	2.7489
30.0	0.1101	0.5033	1.3211	2.9988
32.5	0.1193	0.5452	1.4312	3.2487

TABLE 8 (d = 14 in.)

P%	Di/d 2.5	5.0	8.0	12.0
5.0	0.0250	0.1142	0.2997	0.6803
7.5	0.0375	0.1713	0.4496	1.0204
10.0	0.0500	0.2283	0.5994	1.3605
12.5	0.0624	0.2854	0.7493	1.7007
15.0	0.0749	0.3425	0.8991	2.0408
17.5	0.0874	0.3996	1.0490	2.3809
20.0	0.0999	0.4567	1.1988	2.7211
22.5	0.1124	0.5138	1.3487	3.0612
25.0	0.1249	0.5709	1.4985	3.4013
27.5	0.1374	0.6280	1.6484	3.7415
30.0	0.1499	0.6850	1.7982	4.0816
32.5	0.1623	0.7421	1.9481	4.4217



Portion of electric log of Texaco, Inc., 3 Knudson, Luft field, Logan County, Colorado. Fig. 5.



Portion of electric log of Wytex Oil Corp. 5 Dunn, Southwest Potter field, Kimball County, Nebraska. Fig. 6.

clear and cannot be differentiated by visual inspection from clear formation water. It is filtered when entering the reservoir and again when leaving the reservoir and entering the drill stem. When the reservoir is shaley, the colloidal particles have an effect similar to diatomaceous earth which increases the filtering effectiveness. Thus a more conclusive method than that of visual inspection, in differentiating between mud filtrate and formation water has to be applied.

Mud-filtrate invasion . . . Empirically it appears that a minimum of 50% of the original formation fluid is displaced by mud filtrate. This is a fairly representative as well as a conservative figure making the final results rather conservative. The remaining formation fluid is in the form of (1) irreducible and undisplaced water saturation in water-wet, water-bearing reservoirs, (2) irreducible water saturation and residual-oil saturation in water-wet oil-bearing or transition-zone reservoirs, and (3) residual oil saturation in oil-wet, oil-bearing or water-bearing reservoirs. Based on the above estimate, a set of tables has been calculated and from them a set of graphs of formation-fluid displacement by mud filtrate has been drawn for 1 ft. of reservoir, for various hole diameters, porosities, and most common invasion diameters. The invasion diameter, Di, is expressed as a ratio to hole diameter, Di/d. The porosities in every table range from 5 to 32.5% in 2.5% increments. In the graphs this increment is reduced. Results are expressed in barrels of mud filtrate per foot of reservoir of a given porosity and a given invasion diameter, and termed as Q bbl./ft. of reservoir. This unit is purposely chosen, since the sizes of drill pipe varies, and it is a simple matter to convert this volume to feet of fluid in the pipe by using handbook figures. It is assumed that the mud-filtrate recovery on a drill stem or production test is 100%. This is reasonable because we used a minimum displacement figure of 50% of formation fluid in place, while in reality the displacement could easily exceed this value.

A sample computation for an invasion diameter to hole-diameter ratio of 5, a hole diameter of 9 in., and a porosity of 20% is present below.

$$Q\ (\text{bbl./ft. of reservoir}) = \frac{3.14 \times h \times p \times (S_w)_i \times (Di^2 - d^2)}{4 \times 144 \times 5.615}$$

$$= \frac{3.14 \times 1 \times 0.20 \times 0.50\ [(5 \times 9)^2 - 9^2]}{4 \times 144 \times 5.615}$$

$$= \frac{0.314 \times (2025\text{-}81)}{3{,}234.24} \quad \frac{610.416}{3{,}234.24} = 0.1887$$

where:

- h = thickness, feet (in our case it is 1 ft.)
- P = porosity, per cent
- $(S_w)_i$ = mud-filtrate saturation in the invaded zone, per cent of pore space
- Di = invasion diameter, inches
- d = hole diameter, inches
- 5.615 = ft.³/bbl.

If, from experience, it is known that mud filtrate displaces 70% instead of 50% of formation fluids, then the value of Q (bbl./ft. of reservoir) obtained from graphs or tables should be multiplied by 7/5. Similarly, any other displacement figures may be used.

Since the results presented in Tables 1 through 8 and Graphs 1 through 4 are expressed in barrels, while the drill-stem test or completion data are expressed in feet of pipe, a proper conversion from barrels into feet of fluid in the pipe should be made. The conversion factor may be obtained by multiplying the barrel value by

$$\frac{5.614 \times 4 \times 144}{\pi \times d_i^2} = \frac{1030}{d_i^2}$$

where d_i is the inside diameter of drill pipe expressed in inches. For 4½-in. drill pipe, d_i = 3.826 in.; for 3½-in. drill pipe, d_i = 2.602 in.; and for 2⅞-in. slim hole drill pipe, d_i = 2.151 in. For the most common drill pipe used (4½-in. o.d.), the conversion factor is

$$\frac{1030}{d_i^2} = \frac{1030}{(3.826)^2} = 70.36 \text{ ft.},$$

meaning that 1 bbl. of fluid is equivalent to a stand of 70.36 ft. of fluid in a 4½-in. drill pipe. For 3½-in. drill pipe the conversion factor is 152.13, and for 2⅞-in. drill pipe the conversion factor is 222.62.

Example . . . Let us use an example in the application of these graphs. A 7⅞-inch hole has penetrated a permeable reservoir, the net thickness of which is 20 ft. From MicroLog, electric log, core analysis, or general information, the porosity obtained equals 20%. The mud-filtrate invasion is average and probably 5 hole diameters, but could be 2.5, 8, or 12. In this example, invasion diameters of 5 and 8 will be used, but computations for other invasion diameters should be made in order to see the range of variation.

Using Fig. 2 for $Di/d = 5$ and for a hole size of 8 in. (closest to 7⅞ inches), a value of 0.15 bbl. per ft. is obtained for 20% porosity. For a reservoir 20 ft. thick, the total mud-filtrate volume in the invaded zone is 2.982 bbl. Using a 4½-in. drill pipe, the conversion factor from bbl. into standing feet of fluid in the drill pipe would be 70.36 ft. per bbl. Therefore, 2.982 bbl. equals (2.982×70.36) or 210 ft. Thus, the first 210 ft. of fluid recovered from drill pipe on a drill-stem test is probably mud filtrate. If the invasion diameter is eight times the hole size ($Di/d = 8$), the displacement and subsequent recovery of mud filtrate should be $20 \times 0.3916 \times 70.36 = 550$ ft. of fluid in a 4½ in. drill pipe.

From the above results it may be deduced that a substantial amount of clear mud filtrate may be recovered on a drill-stem test.

Invasion Diameter

There is no precise method to determine the invasion diameter. Experience shows that 2.5, 5, and 8 are the most representative invasion-diameter ratios present in medium porosity, medium permeability reservoirs such as those in the Midcontinent area. Invasion diameter ratios of 2.5, 5, and 8 are present in the Gulf Coast region, where porosities and permeabilities are higher. Invasion diameters of 5, 8, and 12 would be expected in sands of low to medium porosity and permeability, such as those encountered in the Rocky Mountain region. These are approximations, however, and all available data must be used to reach a reasonable conclusion. Some examples may clarify the situation:

(1) Consider the electric log of a well in the Gulf Coast area, on which the short-normal curve registers a low resistivity. Assume that on correction for electrode spacing, hole diameter, and mud resistivity, and subsequent division by the mud-filtrate resistivity there is obtained a ridiculously low formation factor, equivalent to a porosity greater than 40%. This indicates a very shallow invasion, probably less than two hole diameters. (2) Consider now the case where the reading of the short normal equals, or almost equals the true resistivity of the uncontaminated zone obtained from the long normal. Further, let both values be either substantially smaller or greater than the true resistivity obtained from the lateral curve. Then deep invasion in excess of 12 hole diameters exists, and the long-normal curve is measuring the resistivity of the invaded zone. (3) when an induction-short normal survey is available, and both curves register the same corrected resistivity from which a reasonable formation factor may be obtained, then the mud-filtrate invasion is equal to or greater than 10 hole diameters.

The invasion diameter may also be obtained from Schlumberger's Document 7, after making appropriate bed-thickness corrections and fitting the normal apparent resistivity data into the best available curvature.

Field Examples

The log in Fig. 5 is of The Texas Company's 3 Knudson, located in NE SE SW 17-8n-53w, Luft oil field, Logan County, Colorado. The first drill-stem test taken from 4,829-35 ft. in the upper "D" sandstone reservoir of the Dakota formation recovered 2,900 ft. of slightly gas-cut water in 2 hours. The second drill-stem test from 4,832-38 ft., through the same reservoir, recovered 600 ft. of oil and gas-cut mud in 20 minutes, but the packer failed, so the test may be disregarded.

The net reservoir thickness of this zone is 12 ft., and the average porosity is 19% as determined from core analysis. The hole diameter was 9 in. From an appropriate line in Fig. 4, for $Di/d = 12$, we obtain a fluid displacement by mud filtrate of approximately 1.070 bbl. per ft. of reservoir. It is very possible that the invasion is greater than $Di/d=12$, since after correcting the long normal for bed-thickness effect, it records the same resistivity value as the short normal and greater than that recorded by the lateral curve. It is also possible that the lateral curve does not record the full true value. Thus the invasion diameter could be easily 15 hole diameters. Another possibility exists, that the two reservoirs below the one tested are separated by a thin shale streak which does not have to be continuous and could possibly be fractured. Thus the reservoir thickness affected by the drillstem test, especially since it was a double packer test, would then be 19 ft. instead of 12 ft. The mud filtrate present in the invaded zone, whose extent is 15 hole diameters and a reservoir thickness of 12 ft. with a porosity of 19%, is equivalent to a fill up of 3,055 ft. of fluid in a 3½-in. drill pipe with which this well was drilled. The mud filtrate present in the invaded zone, whose extent is 12 hole diameters and a reservoir thickness of 19 ft. with a porosity of 19%, is equivalent to 3,093 ft. of fluid in a 3½-in. drill pipe. The subject well was subsequently completed as a producer through perforations from 4,829-35 ft. with an initial production of 216 bbl. of oil per day and 4% water. The well eventually cleaned up completely and produced water-free oil. Thus it is entirely possible to recover 2,900 ft. of clear water in a 3½-in. drill pipe and complete the well as a commercial water-free oil producer.

The log in Fig. 6 is that of the Wytex Oil Corp.'s 5 Dunn, located in NE NW SE 3-13n-53w, Southwest Potter field, Kimball County, Nebraska. A drill-stem test taken from 5,518-38 ft. through several "D" sandstone reservoirs was open 1½ hours and shut in 15 minutes. Some gas reached the surface in 63 minutes and the pipe recovery consisted of 720 ft. of oil and gas-cut water. A second drill-stem test over the same interval recovered 600 ft. of oil and 300 ft. of water. The average porosity of the "D" reservoirs in this field, as obtained from core analysis is 18%, the hole size 9 in., and the total net reservoir thickness in this well is 23 ft. Using Figs. 2, 3, and 4 for Di/d ratios of 5, 8, and 12, we obtain the fluid displacement by mud filtrate in 1 ft. of reservoir to equal respectively 0.170, 0.445, and 1.010 bbl. Converting these values into a fillup in a 4½-in. drill pipe and for a reservoir thickness of 23 ft., we obtain respective values of 275, 720, and 1,634 ft. of fluid. Since the total water recovery in both tests was 1,020 ft., it appears that the mud-filtrate invasion was somewhere between 8 to 12 hole diameters. Thus before recovering any formation fluid, all the mud filtrate had to be recovered. This well was also completed as a successful producer with an initial production of 155 bbl. of oil per day, 10% water cut. The well cleaned up subsequently, producing water-free oil.

Conclusion . . . These actual field examples confirm the theoretical computations that a substantial amount of fluid which appears to be formation water, but is actually clear mud filtrate, may be recovered on a drill-stem or production test.

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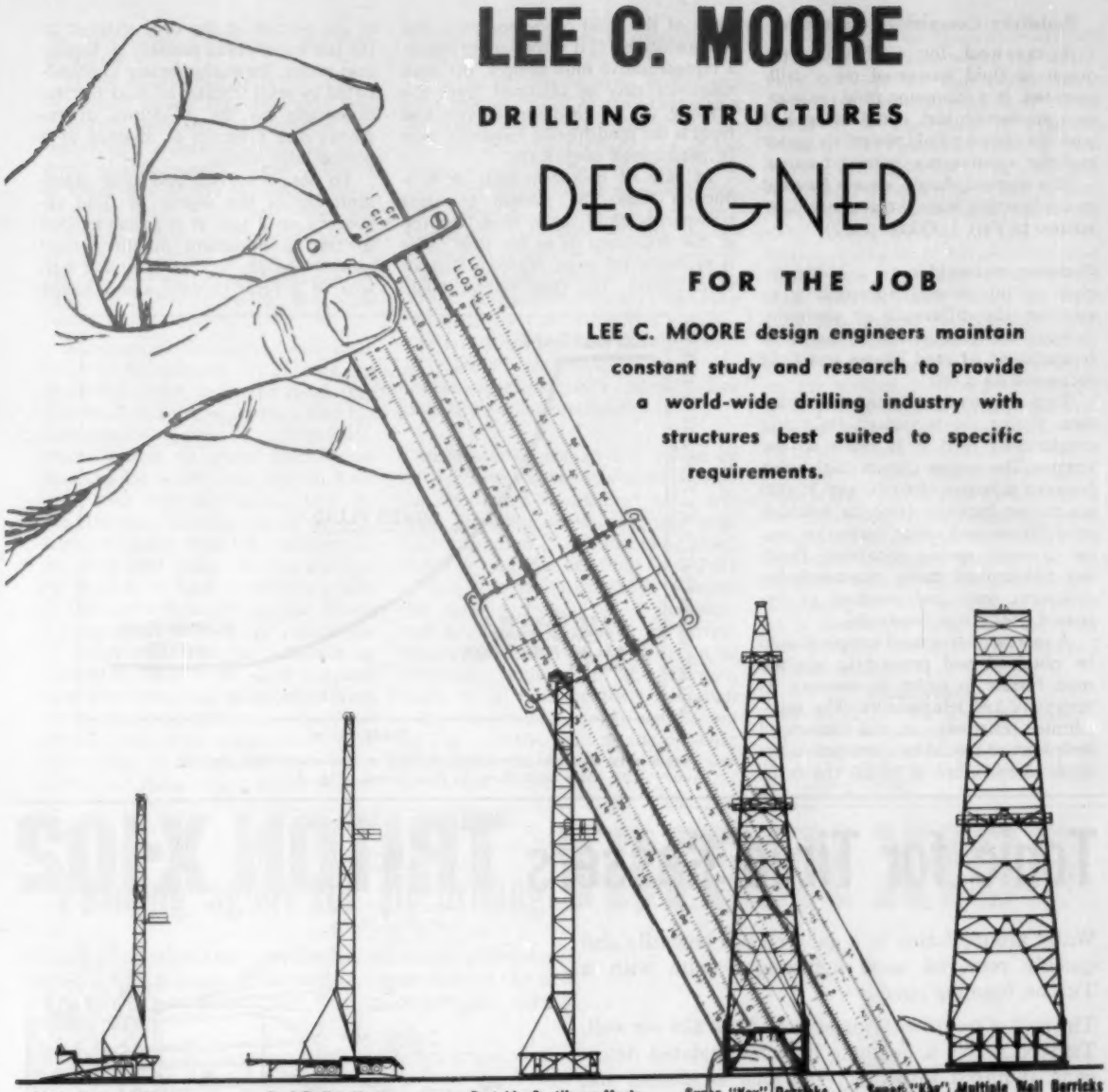

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Resistivity Comparison Approach

A method for establishing the origin of fluid recovered on a drill-stem test, in a formation fluid sampler, or a production test, could be applied with the aid of a fluid resistivity meter and the spontaneous potential curve.

This method should always be used in conjunction with the approach described in Part 1 (O&GJ 1957).

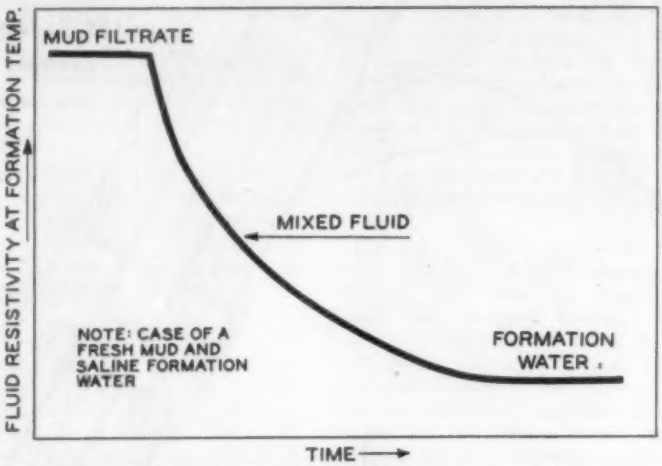
Compare resistivities . . . The principle of this second approach is to establish the difference or similarity between the resistivities, at the same temperature, of mud filtrate and fluid recovered on a test.

This approach is more accurate than testing the recovered fluid and condemning it if it is saline to the tongue. The tongue cannot distinguish between salinities of 6,000 and 30,000 p.p.m., or between fresh to brackish mud filtrate and saline formation water. Tongue tasting recovered fluids has condemned many nonconclusive drill-stem tests and resulted in bypassed productive reservoirs.

A representative mud sample should be obtained and pressed to get the mud filtrate in order to measure its resistivity and temperature. The mud-filtrate resistivity at the measured temperature should be corrected to the same temperature at which the resistivity of the fluid recovered on a test was measured. If it is too late to obtain a representative mud sample, the mud resistivity may be obtained from the heading of an electrical survey and from it the mud-filtrate resistivity may be determined empirically.

In case of drill-stem tests or production tests, the sample of clear transparent fluid taken from the top of the drill stem or in the first bailer is probably the most representative of mud filtrate. The fluid sample taken at the bottom of the drill stem or in the last bailer could possibly be formation water, formation water contaminated by mud filtrate, or mud filtrate, depending on the quantities of recovery and presence or absence of a permeability block.

To obtain a vivid and clear representation of the source of fluid recovered on a test, it is recommended to take a minimum of three fluid samples, at the top, middle, and bottom of a fluid column and measure



Resistivity of fluid produced during a drill-stem test should vary with time according to this curve. Fig. 7.

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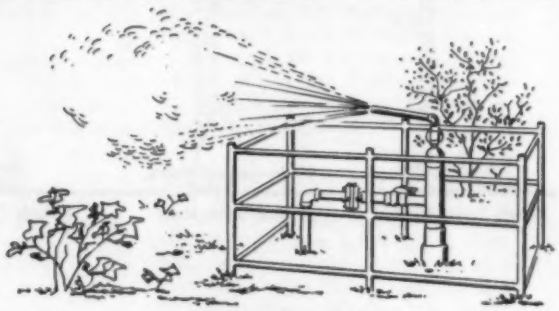

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the respective resistivities and temperatures.

If the mud-filtrate resistivity equals or almost equals the recovered fluid resistivity, and the spontaneous potential (S.P.) deflection on the electrical survey, opposite the reservoir or reservoirs within the test interval, is larger than ± 10 mv., then the recovered fluid is mud filtrate. If the S.P. deflection is less than ± 10 mv. and the above conditions prevail, the fluid recovered on the test could be formation water.

However, if the mud-filtrate resistivity is substantially larger than the resistivity of the recovered fluid, then this fluid is formation water. The last comparison applies to fresh-water muds present in wells which penetrated saline water reservoirs. If, however, the opposite exists, then the mud-filtrate resistivity should be substantially lower than the resistivity of the recovered fluid, for this fluid to be brakish or fresh formation water.

The above technique applies also to a comparison between the resistivities of tested water and the resistivity of formation water at the same temperature. The latter may be obtained from the spontaneous potential curve, from an S.P. plot, from general knowledge of a range of formation-water resistivities, or from measurement of formation-water samples recovered from corresponding reservoirs in wells drilled in the general area. In all cases it is recommended that a comparison be made between the mud-filtrate resistivity and the resistivity of tested water, as well as the computed or obtained formation-water resistivity, and the resistivity of tested water. Since resistivities vary with temperature, all comparisons have to be performed at some arbitrarily chosen temperature. These comparisons between fluids may be made by converting the resistivities taken at respective temperatures to salinities expressed in parts per million (p.p.m.), since salinity does not vary with temperature.

Continuous record . . . It would be of significant value of a fluid-resistivity instrument is attached to a drill stem, recording continuously the resistivity variation of the incoming fluid. Such a record of fluid resistivity versus time would establish whether the fluid recovered on a drill-stem test is all mud filtrate or all formation water, if there is no variation of resistivity with time. If, however, there is a fluid-resistivity variation with time, then a graph represented by Fig. 7 would indicate the presence of mud filtrate, mixed with fluid, and at the end, formation water.

Without a continuous fluid-resistivity record, in cases where the difference between the mud-filtrate resistivity and formation water is rather small, it is impossible to establish whether the recovered fluid is mud filtrate, formation water, or a mixture of both, and if so, in what proportion. With the continuous fluid-resistivity record, there is no fear of any mixing taking place between the mud filtrate and formation water in the drill stem, especially when the total fluid recovery is rather small. Also if a continuous record of a resistivity variation of entering fluid is recorded on the surface, it would be possible to determine more accurately the time interval to leave the tool open. One certainly would not shut the tool if the record shows that only mud filtrate is entering the drill stem. Though the above suggestion would be somewhat complicated to materialize in drill-stem testing, it should pose no difficulty whatsoever in the formation-fluid sampler. The sampler is lowered on a conductive cable and the fluid and pressure buildups are recorded on the surface.

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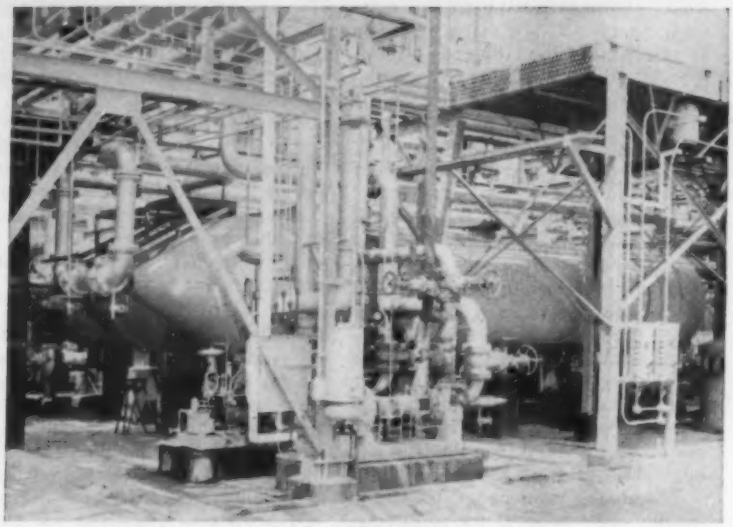

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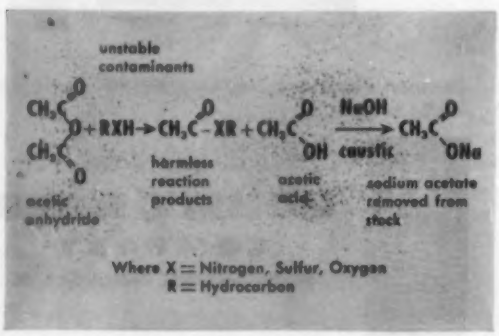
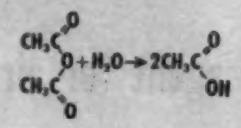
While the complex chemical nature of components in most stocks make definite identification of reactions difficult, the following reaction offers a possible explanation of how the process functions:



Nalfining is also effective with fuels containing water haze following distillation. Apparently this is possible because hydrolysis of acetic anhydride proceeds at a slower rate than the primary reaction.

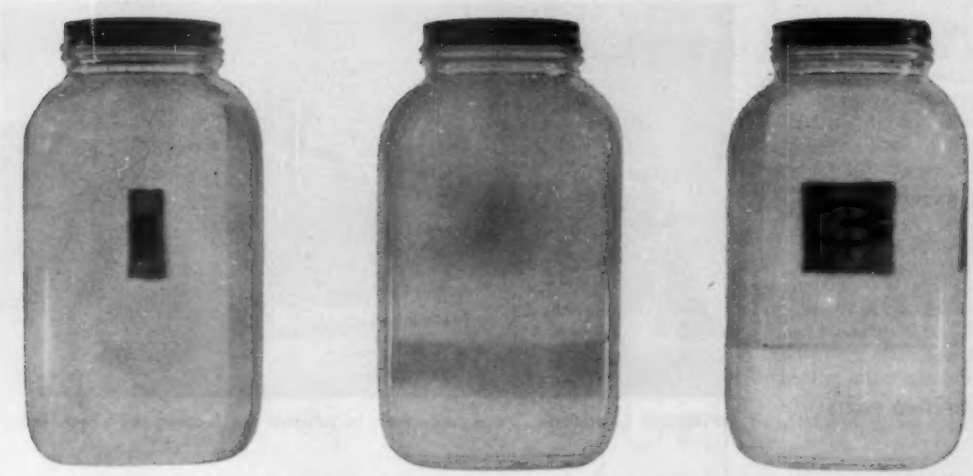


Equipment Costs Low

Installing the Nalfining process is much less costly than that for most refining processes because the required equipment is very simple, and expensive instrumentation and control costs are eliminated. Successful Nalfining installations have been set up by utilizing process vessels or tanks formerly used for caustic or acid treating operations. Aluminum storage tanks, pumps and lines to handle acetic anhydride are normally the only new equipment necessary.

Few, Simple Process Controls

Day-to-day control of Nalfining consists of simple tests to check reagent concentrations, completeness of reactions, and treated product quality. Other than these few tests, which can be made with equipment readily available in any control laboratory, and minor adjustments for operation, there are *no* other personnel needed for Nalfining . . . With reliable pumps and equipment, process upsets *do not* occur.



Jar at left (1) is raw fuel oil. Center jar (Numeral 2 obscured) is same oil with caustic added. Note haze in oil and "rag" of impurities extending from oil-caustic interface into caustic. Jar at right (3) was treated with both acetic anhydride and caustic. Stock is clear, there is no "rag" or residue at oil-caustic interface, and stabilized product will stay clear, free of objectionable odors through storage, shipment and trouble-free use.

Nalco Service Provided

All Nalfining units are provided with the regular services of Nalco Technical Representatives, who conduct tests and take samples to provide detailed information on process effectiveness, unit performance and quality of finished product. Regular reports are made to refinery personnel.

Nalfining a Wide Range of Products

Experience to date with Nalfining proves successful, low-cost upgrading of heating oils, solvents, jet fuels, gasolines, kerosenes and other distillate stocks. Throughput volumes today range from laboratory pilot plant operations to 20,000 bpd processing of light cycle oil. Nalfining itself is capable of volume of throughput equal to any desired rate.

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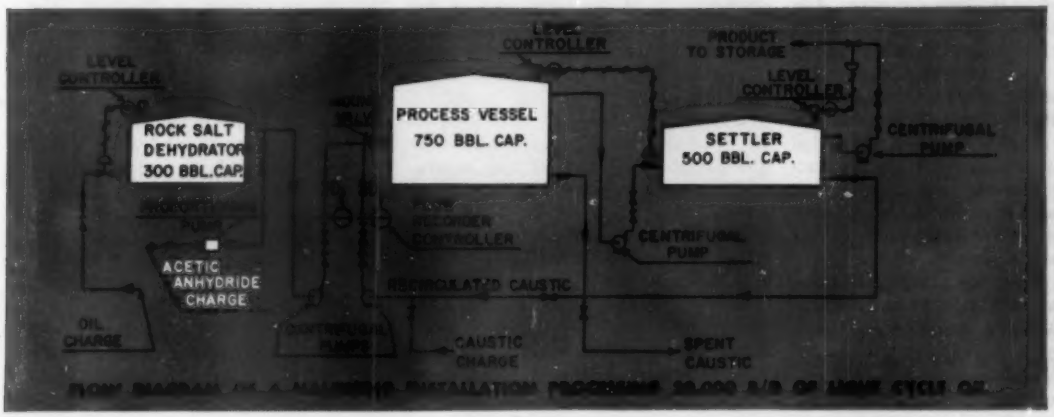
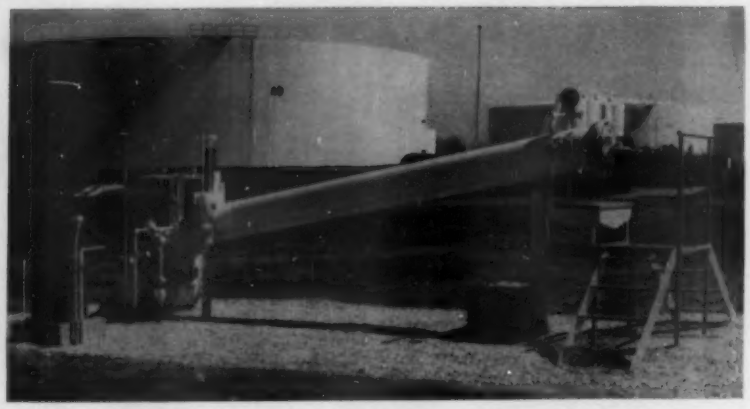


Nalco CHEMICALS

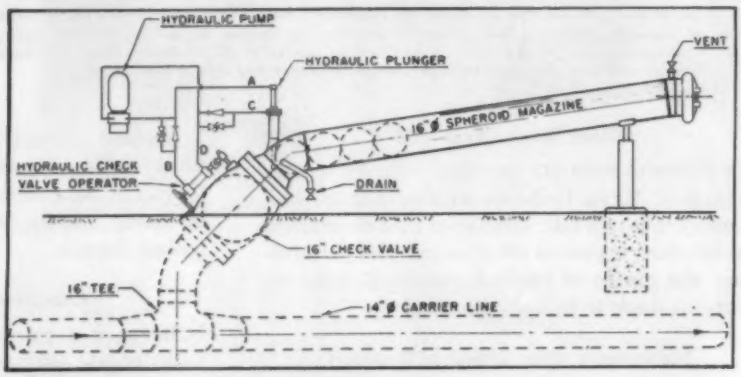
BY M. L. BARRETT, JR.
Senior Engineer, Research and Development Department, Shell Oil Co., Indianapolis

PART 2 OF TWO PARTS



SPHEROID LAUNCHER, 14-in. diameter, is isolated for loading by check valve. Fig. 8.

The pipeline spheroid



SCHEMATIC DRAWING of check valve-type spheroid launcher. Fig. 9.

. . . an effective technique for fluid separation

ANY PROGRAM of separation of fluids necessarily starts at the source of a pipeline. There, to avoid stopping the pipeline flow, it is common practice to start flow of the trailing product before stopping the leading product.

This means that at an originating station, such as shown schematically in Fig. 10, there will be an interfacial mixture generated in the manifold valve area and through the pump. The volume will be primarily dependent upon (1) the length of time during which the two switched suction manifold valves are simultaneously open, (2) the rate of flow during this period, and (3) the amount of added intermixing which occurs in the suction piping, strainers, meters, pump or pumps, and other station piping.

This volume of interface at Wood River pump station at the spheroid launching point has been determined to be between 70 and 90 bbl. under all normal operating conditions. Fig. 7 shows it as being approximately 80 bbl.—an average figure. (We cannot presently actually launch spheroids at this point but must launch them approximately 1 mile downstream where the interfacial volume was 118 bbl. as shown for the Wood River discharge curve.)

In keeping with the technique discussed in the earlier part of this paper, we want to launch the first spheroid immediately at the head end of the interface as it approaches the launcher. Subsequent spheroids, up to the most economical number required, are to be launched at approximately equal intervals of not less than 120 lineal ft. of pipeline with the last spheroid at the extreme tail end of the interfacial mixture or in pure trailing product.

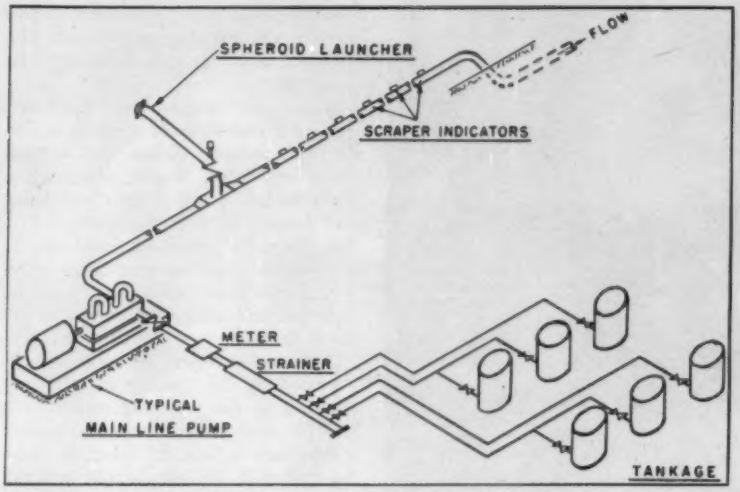
Let's look first at the method of launching spheroids into the line. Fig. 8 is a picture of a "pin ball machine," as they've become known in our organization, suitable for dropping as many as 10 spheroids into the pipeline at less than 15-second intervals if desired. The launcher may be constructed in many different forms but is basically a device for controlling spheroids as they try to fall by force of gravity into the pipeline.

In the schematic view of Fig. 9, an oversized tee is swedged into the carrier pipeline. To the tee is attached an oversized power-operated clapper-type check valve and an inclined piece of oversize pipe with closure which serves as a magazine for the desired number of spheroids. The clapper of the check valve and the spheroid-retaining plunger just ahead of the valve are operating by hydraulic pistons which are fed oil from a hydraulic unit having a self-contained oil sump and reversing-type pump.

The launcher is loaded with spheroids with the check-valve power closed and the retaining pin withdrawn. When electric signals command a spheroid to be launched (1) the retaining plunger is inserted, (2) the clapper opens to allow one spheroid to fall through, (3) the clapper closes, and (4) the plunger is withdrawn.

The spheroid falls into the oversize

Paper presented at tenth annual pipeline conference, under auspices of API Division of Transportation, Pittsburgh, May 13-14.



METHOD OF LAUNCHING spheroids in spaced relationship is shown in schematic view of an initial pumping station. Fig. 10.

tee and is immediately washed into the carrier line. Fig. 11 shows a variation of the type of launcher just described which we have installed on existing conventional scraper launching barrels. Here the launcher is isolated from the carrier line for loading by means of existing block valves on the scraper barrel and no check valve (or gate valve) is used in the spheroid magazine barrel.

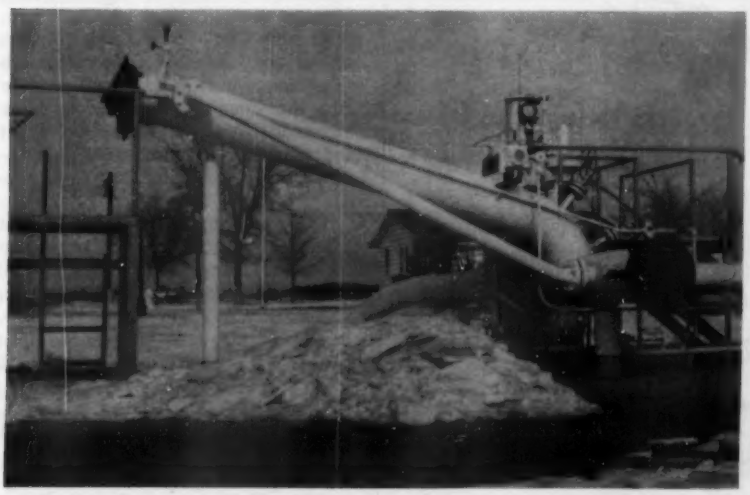
Instead the two plungers on the bend of the barrel are spaced one spheroid apart and when electrical signals command a spheroid to be launched (1) the upper plunger is inserted, (2) the lower plunger is retracted to allow a spheroid to fall, (3) the lower plunger is inserted, and (4) the upper plunger is retracted. These plungers are operated by small hydraulic pistons.

Returning to Fig. 10, there are no doubt a number of ways to make automatic or semiautomatic the proper insertion of spheroids in an originating interfacial mixture. A reasonably simple method involves the use of a present time delay based on existing flow rate and piping-wash volume from manifold to launcher. It would start at the instant two suction manifold valves become simultaneously open and time out as the head end of the interface approaches the launcher.

The end of the time delay would electrically signal the launcher to release the first spheroid not later than at the head end of the interfacial mixture. The first spheroid will move out into the carrier line not less than 120 lineal ft. where it will encounter the first of a series of strategically located scraper indicators.

By remotely preselecting an indicator which meets the requirements of spacing imposed in Fig. 4, this particular indicator, when struck by the first spheroid, electrically signals the launching of the second. The second signals the launching of the third, and so on until the desired number have been released during the transition of the interface past the launcher.

This control can also be done with an adjustable and preset-time repeater controller where there is no danger of flow-rate change or a station shutdown during the interface passage. And so the spheroids are on their way with the interfacial mixture, as for instance, the five spheroids shown on the Wood River discharge curve of Fig. 7.



HIGH-SPEED spheroid launcher, 14-in., is isolated by carrier line block valves and a bypass. Fig. 13.

Automatic Bypassing

Shell intends ultimately to remotely operate the five intermediate pumping stations on its 14-in. Wood River-East Chicago line from a control center at Indianapolis.

With unmanned stations, it is planned to pass the interface-protecting spheroids through each station completely automatically by a scheme which does not disturb the normal liquid-flow pattern at any station nor require stopping or throttling the pumps. An over-all picture of a typical automatic station bypass which is presently being developed is shown in Fig. 12.

The rather unconventional features of the piping are, of course, the height to which the spheroids are brought as they come into the station piping area, the spheroid separator, and the arrangement of the two power-operated check valves installed vertically and flange to flange between the overhead station suction pipe and the normal-level station discharge pipe.

Fig. 13 is schematically illustrative of the details of the bypass piping. The volume of liquid (shown as cross-hatched) contained in the pipeline from scraper indicator A to scraper indicator B is made to equal exactly the volume of liquid (shown as dotted) contained from scraper indicator B through the pump suction line, the pump, and pump discharge line to indicator C at the oversized tee junction on the discharge. This dotted volume is the station wash volume.

By measuring the time it takes a spheroid to pass from A to B, the pipeline flow rate for that spheroid is indexed to the control circuit so that when a spheroid strikes B that length of time is allowed to lapse before the spheroid is replaced in the discharge line at indicator C. Through this means each spheroid is replaced in the station discharge stream at exactly the same point it was upon arrival at

AUTOMATIC SPHEROID BYPASS in 14-in. carrier line at DeWitt, Ill., pumping station. Fig. 12.

indicator B. The pump continues to run at full speed during the spheroid transition and no flow occurs through the check valves No. 1 and 2.

To accomplish this note that immediately downstream from indicator B, the pipe, spheroid separator, check valves and bottom tee are one pipe size larger (16 in.) than the carrier line (14 in.). The spheroid is brought into a vertical perforated sleeve surrounded by a still larger tee containing the pump suction line proper. It is at this junction that the spheroid leaves the flowing liquid and falls downward by gravity onto the flapper of check valve No. 1 while the liquid moves on toward the pump through the tee outlet.

With the first of a series of interfacial spheroids on top of No. 1 check valve, the hold pin is first hydraulically inserted, equalizing valve 1-C is opened to equalize the pressure across the top check valve No. 1 whereupon this top check valve is hydraulically power opened, held approximately two seconds and then is power closed. The spheroid falls through it during this operation.

Valve 1-C closes and equalizing valve 2-C immediately opens to equalize the pressure across the bottom check valve No. 2 and, upon signal from the timing controller, check valve No. 2 opens to drop the spheroid into the discharge stream at indicator C. The immediate closure of check valve No. 2 then closes valve 2-C, pulls the hold pin and places the bypass in position to handle a subsequent spheroid.

This sequence will be automatically repeated by any number of spheroids arriving at the pumping station. As pointed out earlier, the only qualification here is that the spheroids must be spaced in the interface at intervals of time which are not less than the cycling time for the bypass. Otherwise the bypass will not replace them in the stream at the point where they were removed. This cycling time, in the case of Shell's 14-in. bypasses, is about 23 seconds.

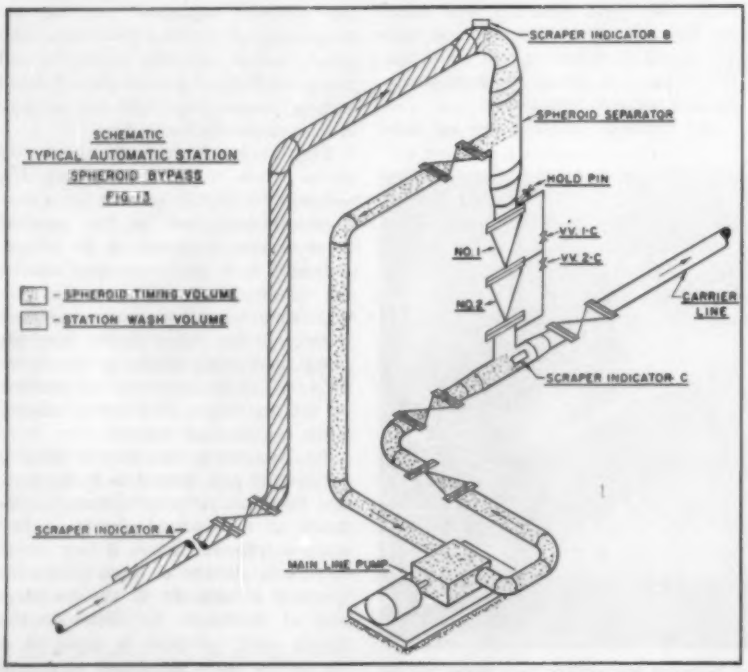
Passing Spheroids to Laterals

In general, any spheroid will try desperately to go with a fluid stream into side outlets of a pipeline. We have even experienced accidents in which a 14-in. spheroid left the 14-in. carrier line, passed through some 70 ft. of 12-in. pump suction line and broke up at the 10-in. pump suction connection. Conversely, if there is no flow through such a side outlet, a spheroid may tend to hesitate or even stop there completely if the rate of flow is low enough for the fluid to bypass the spheroid without being able to move it.

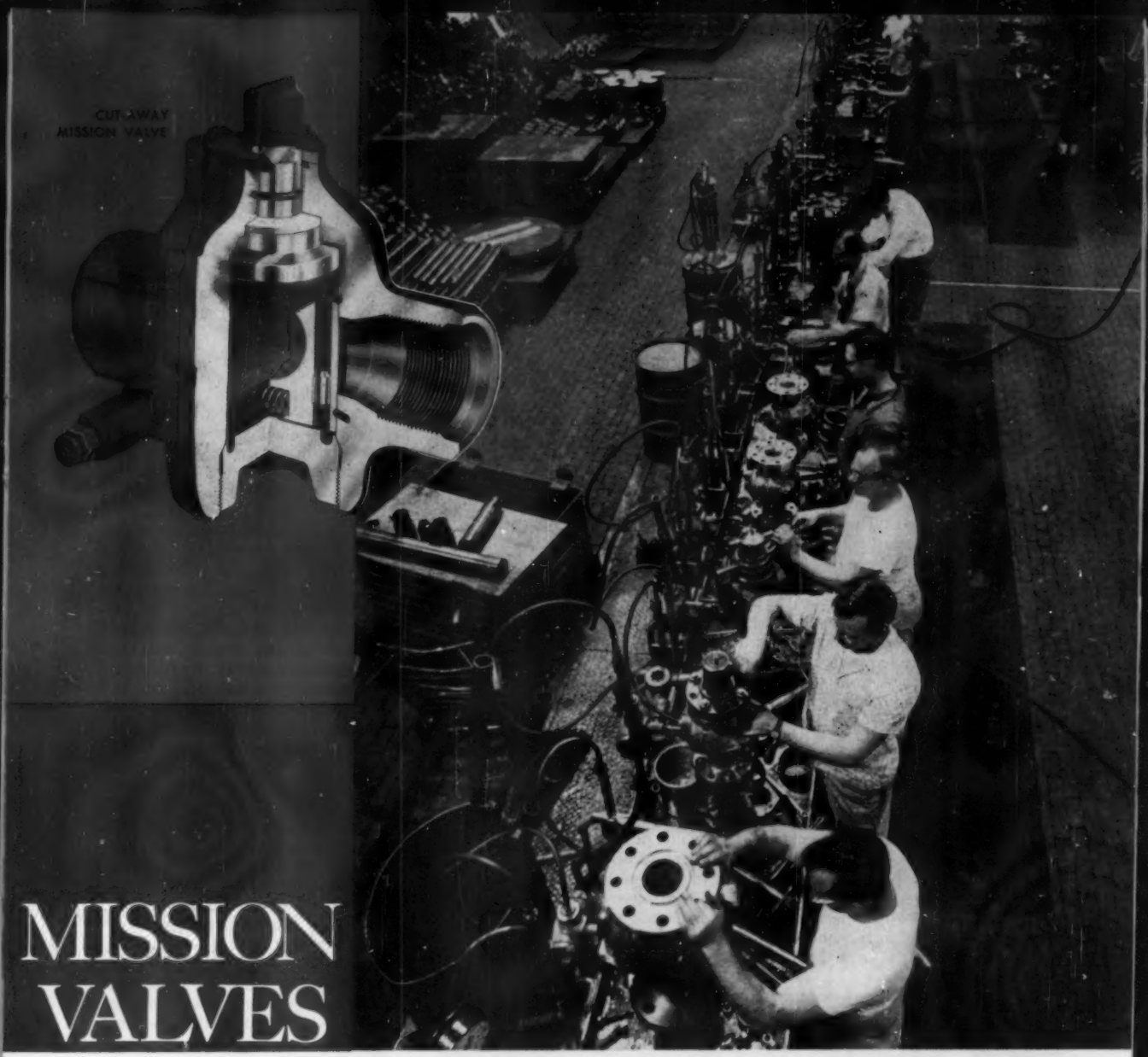
Such characteristic performances of the spheroid were employed in the design of the junction to Argo and East Chicago shown in Fig. 14. The 14-in. Argo and East Chicago block valves are remotely controlled. Fourteen-inch spheroids protecting an interface come into the junction point through the incoming 14-in. line at the lower left and enter a 16-in. diameter pipe between the valves with 14-in. side outlets to the two valves.

The spheroids are diverted at right angles at these 14-in. side outlets to either the right outlet (East Chicago) or the left outlet (Argo) depending on which valve is open to take the flow. In Fig. 15 they pass through the open valve, turn a right angle again into a long 20-in.-diameter barrel, and are then on their way to destination in the particular leg carrying the flow.

Facilities still under development for a special operation in the Argo lateral at Peotone Junction are shown in Fig. 15. The incoming line is de-



SCHEMATIC VIEW of automatic spheroid bypass shown above. Fig. 13.



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SPHEROID DIVERSION PIPING at main-line junction to Argo and East Chicago located near Peotone, Ill. Fig. 14.

noted by arrow and comes into the junction from the left. This Argo leg normally takes only heart cuts of product from the Wood River-East Chicago line. Because of this, an interface is created in the Argo leg as the Argo valve is remotely opened.

To minimize the spread of this interface, it is to be protected by spheroids automatically launched from the 20-in.-diameter spheroid-holding barrel. This barrel is preloaded with the desired number of spheroids brought into it at the tail end of a delivery to the leg and held by the inserted plunger No. 2.

When a subsequent delivery is made, the spheroids are awaiting launching from the barrel. As the Argo valve begins to open, (1) plunger No. 1 is inserted, (2) plunger No. 2 is withdrawn, (3) plunger No. 2 is inserted and (4) plunger No. 1 is withdrawn. These plungers are shown in Fig. 16.

This cycle takes about 5 seconds and launches the first spheroid. This first spheroid moves out 120 ft. into the line where it strikes a scraper indicator whose signal launches the second spheroid. Similarly, the second spheroid, as it strikes the indicator, launches the third and so on until all of the spheroids have left the barrel. It is anticipated that three spheroids 120 lineal ft. apart, with the first one at the head end of the interfacial mixture generated as the Argo valve opens, will provide sufficient protection for such movements to Argo.

Upon final arrival at either Argo or East Chicago further north, the spheroids enter a sufficiently long 20-in.-diameter receiving barrel such as shown in Fig. 17 which is then bypassed to remove the spheroids from the pipeline.

There are a number of mechanical and operational advantages of spheroids themselves and equipment which can be designed for their handling which implement the effectiveness of a fluid-separation system using them.

1. Each spheroid is as effective a fluid separator as a single dumbbell-type scraper used in the past.

2. Spheroids, being round, are more easily handled than scrapers, for the force of gravity can be employed to roll or drop them in a fluid. This makes them highly conducive to manipulation in automatic equipment such as the launcher and the automatic station bypass.

3. They can be handled (per unit) in smaller launching and receiving equipment than previous separators and, since the launching is positive, automatic, and rapid once inaugurated, more separators can be precisely injected into a single interface than was formerly possible.

4. Spheroids have a wear life of 10 to 15 times that of disk or cup-type scrapers, can run through at least a 250-mile 14-in. line without additional inflation and may be quickly resized, when required, by adding water with a small pump.

5. Some types of elastomers tend to wear a circumferential flat on the spheroid exterior if inflated too large. However, such a flat does not affect the sealing ability of the worn spheroid when its minor axis is properly sized.

6. Spheroids have the ability to readily negotiate long radius, short radius, and even mitered ells, to jump out of the side outlet of a tee, to be propelled (even upward) through oversized piping, and to negotiate satisfactorily a pipe at least one size smaller than the nominal spheroid size. They will form an absolute shutoff if brought through a line into a suitable swedged reducer but if the pressure behind them is too great they will go on through. But a word of caution—they will stick in the bulbous types of check valves at low rates of flow.

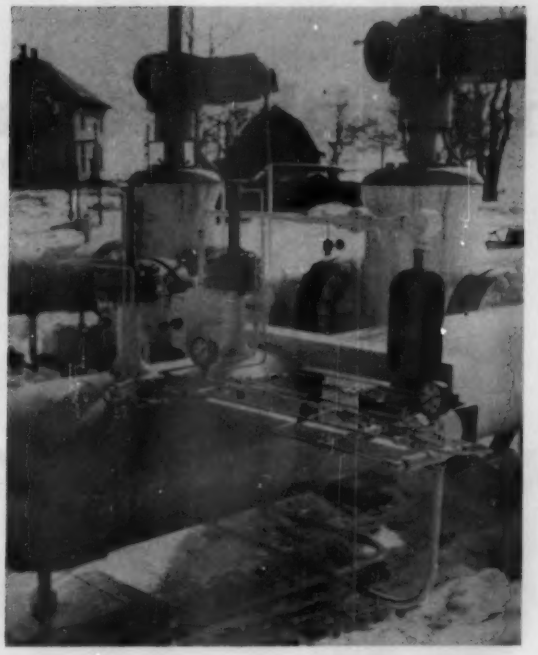
7. Spheroids require a relatively small amount of fluid energy for movement. We have had as many as 20 of them moving in one line section at one time and were unable to determine any significant pressure changes on the station gages.

SPHEROID-HOLDING and automatic launching barrel at Peotone showing path of spheroid from main line to Argo. Fig. 15.

Summary

The outstanding potential of spheroids lies in the economies of pipeline operation which they can effect and to which they can indirectly contribute, for:

1. The proper use of multiple spheroids, particularly in larger-diameter lines, is an effective method of controlling and reducing interfacial mixing of contiguous flowing fluids where such mixtures must be disposed of at



HYDRAULIC PUMP, piping, and dual plungers for automatic spheroid launching. Fig. 16.

destination at reduced prices over those obtained for pure fluids. Results of our work indicate that the generation of mixture decreases as the number of spheroids employed in an interface increases.

For instance, five spheroids between a gasoline-burning oil interface in our 14-in. 250-mile line can reduce the interfacial mixture to approximately one-third that obtained without mechanical protection. Additional spheroids have brought that figure down to around 25%.

Since gasolines and other products continue to enter our pipelines as time goes by with higher and higher specifications for octane, end point, etc., the economies which we can effect with spheroidal separation become more attractive as we lose our ability to blend off unsalable material.

2. The spheroid has proven to be an unusually satisfactory means of displacing or evacuating a fluid from a pipeline. One such installation which has worked for us very effectively involves the complete evacuation of warm glycerin from an 8-in. 1,600-ft. barge unloading line in about 15 minutes with one pass of a spheroid pushed by air pressure. Spheroids are serving as a means of both filling and emptying lines of water in hydrostatic tests, for displacing products and for chasing out pockets of gas and/or water.

3. The spheroid itself is more economical to operate than the dumbbell-type scraper. The cost to run two dumbbells to protect an interface from Wood River to Chicago is approximately $165 whereas two spheroids can make the trip equally effectively for around $65.00 or less, a reduction in material costs of some 60%.

4. Operating labor costs at the extremities of the pipeline for this interface-control program will not be materially reduced over our present system until automatic features are installed. But the labor costs for scraper handling at the intermediate booster stations will be reduced to zero by means of the automatic station bypasses.

This will contribute indirectly to still further savings which we plan to effect by placing the intermediate pump stations on full remote control.

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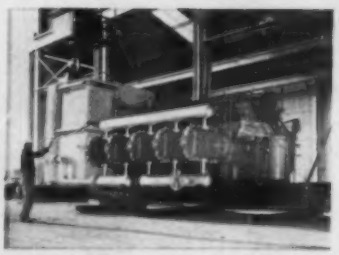

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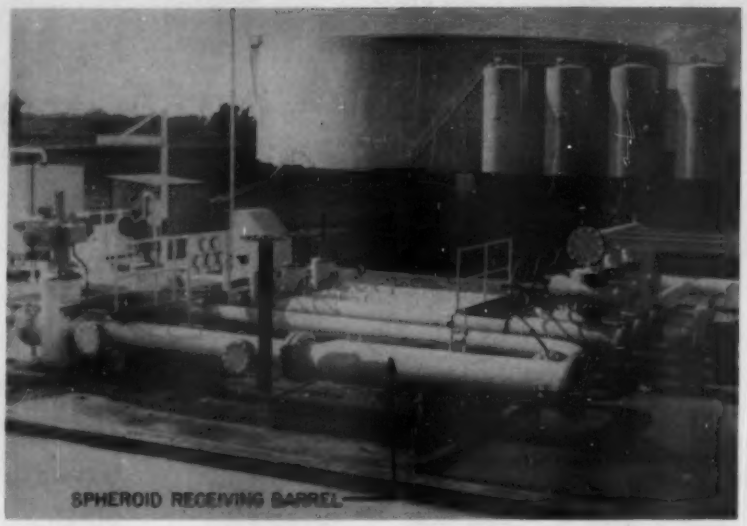

SPHEROID RECEIVING barrel at terminus of 14-in. line at Argo. Fig. 17.

This latter program will be enabled and implemented by fully automatic spheroid manipulation at each of these stations.

5. Spheroid-handling equipment can be built new for approximately the same construction cost as conventional-scraper launching and receiving barrels and related piping for the spheroid facilities normally require fewer valves.

6. Spheroidal separation offers the possibility of economically handling smaller batches of petroleum liquids thus reducing capital expenditures for tankage and providing the ability to supply a market with smaller maximum inventories.

7. An as yet unexplored potential of the spheroid may lie in the fact that, since more of them can be launched in an interface, it may be possible to expand the number and type of fluids handled in a single pipeline. This necessarily might involve other considerations such as alternate freight charges, heavy line loads, quantities, etc. However, multiple spheroids present powerful pipewall surface-wiping ability with a wash time between each spheroid. We hope soon to do some work along this line.

8. Also unexplored is the possibility of further using the spheroid as a mechanical flag in the fluid stream. The correctly sized spheroid is positive in its ability to identify a point in a moving stream and this fact may prove useful as the sensing means in identifying interfaces, tender cutting, tank switching or other operations which could be more accurately performed if they were automatic.

9. The use of the spheroid in pipeline service is in its infancy and much more work must be done in the search for better elastomers, better hardware, and better techniques. But the work that Shell has done is culminating in an all-out batch separation program for its 14-in. north line and gives us sound reason to believe that the spheroid can take its place as a useful tool for better fluid separation and fluid displacement than we have ever before been able to obtain.

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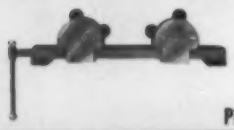

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TULSA, OKLAHOMA

Refinery jobs and wage rates—Part 2

BY W. L. NELSON
Technical Editor and
Petroleum Consultant

Category—	Ratio to avg. wage of workers*
Maintenance and Construction:	
Supt. construction and maintenance	.....
Maintenance supervisor	.....
Construction foreman	.....
Maintenance foreman	.....
Planning foreman	.....
Craft foreman (see below)	
Asbestos and paint shop—	
Working foreman	1.11-[2]
Sign painter and decorator	1.10-[1]
Painter, first class	1.06(1.02-1.09)-[3]
Painter helper	0.94-[1]
Painter rough	0.86(0.78-0.91)-[2]
Sand blaster	0.99-[1]
Cement finisher	.....
Insulator	0.91(0.78-1.02)-[3]
Insulator helper	0.86(0.73-0.94)-[3]
Laborer	0.87-[3]
Common labor	0.81-[2]
Boiler shop—	
Inspector	1.15-[1]
Layout man	1.14-[1]
Boiler maker, steel worker	1.07(1.06-1.09)-[2]
Fitup man	.....
Blacksmith	.....
Blacksmith helper	.....
Blacksmith apprentice	.....
Tool-room man	1.02-[1]
Boilermaker helper	0.98(0.96-1.00)-[2]
Second helper	0.93-[1]
Third helper	0.87-[1]
Carpenter shop—	
Gang foreman	1.28-[1]
Maint. carpenter	1.12(0.96-1.20)-[5]
Carpenter, first class	1.15(1.04-1.30)-[3]
Carpenter helper	0.99(0.96-1.02)-[4]
Carpenter, rough	0.94-[1]
Carpenter helper	0.92(0.91-0.93)-[2]
Form builder	.....
Car bracer	.....
Laborers	0.87-[1]
Electric shop—	
Electrical foreman	1.22-[1]
Maint. inspector	1.27-[1]
Maint. elec. or lineman	1.10(0.92-1.29)-[11]
Electrician, temporary	1.43-[1]
Lineman, temporary	1.43-[1]
First helper	0.96(0.73-1.05)-[5]
Second helper	0.93-[1]
Elec. motor repairman	.....
Tele. troubleshooter	1.07-[1]
Lamp washer	0.93-[1]
Laborer	0.87-[1]
Instrument shop—	
Repair foreman	1.22-[1]
Repairman	1.09(1.01-1.29)-[9]
First helper	1.00(0.98-1.01)-[3]
Second helper	0.92(0.91-0.93)-[2]
Meter repairman	.....
Gas governor repair.	.....
Chartman or changer	0.87-[1]
Welding shop—	
Foreman	.....
Master welder (comb.)	1.22(1.09-1.29)-[11]
Welder (combination)	1.05(0.95-1.12)-[7]
First helper	1.01(0.98-1.06)-[3]
Second helper	0.96(0.91-1.02)-[3]
Third helper	0.80(0.73-0.86)-[2]
Arc welder	.....
Acetylene welder	.....
Material reclaimer	.....
Chipping, peening, etc.	1.09-[1]
Lead burner (acid plant)	1.16(1.12-1.21)-[2]
Lead burner, B	1.03-[1]
Lead burner helper	0.93-[1]
Labor	0.87-[1]
Machine or pump shop—	
Foreman	.....
Special machinist	1.14-[1]
First class machinist	1.09(1.06-1.21)-[6]
Second class machinist	1.00(0.98-1.05)-[4]
First helper	.....
Second helper	1.00-[1]
Tool-room man	0.93-[1]
Valve grinder and machine operator	0.93(0.92-0.94)-[2]
Molder	1.09-[1]
Molder helper	0.97(0.93-1.00)-[2]
Engine repairman	1.06-[1]
Master mechanic	1.22-[1]
Mechanic (auto)	0.98(0.91-1.08)-[6]
Mechanic helper	0.87(0.68-0.97)-[8]
Pump repairman	0.93(0.84-1.05)-[8]
Pump helper	0.79(0.68-0.87)-[4]
Truck mechanic	.....
Laborers	0.87-[1]
Sheet metal shop—	
Tinner, first class	1.09-[1]
Tinner, second class	1.02-[1]
First helper	0.99-[1]
Second helper	0.93-[1]
Pipe shop—	
Foreman	.....
Pipe fitter and welder	1.14-[1]
Utility man or plumber	1.14-[1]
Pipe machine operator	1.03(0.97-1.09)-[2]
Pipe bender	1.09-[1]
Pipe-fitter foreman	.....
Pipe fitter	1.08(0.78-1.18)-[6]
First helper	0.97(0.73-1.03)-[5]
Second helper	0.91(0.89-0.93)-[3]
Utility pipe cutter	1.04-[1]
Cement and brickwork—	
Mason foreman	1.76-[1]
Brick mason	1.35(1.06-1.64)-[2]
Plasterer foreman	1.67-[1]
Plasterer	1.55-[1]
Cement finisher	1.31-[1]
First helper	1.00-[1]
Second helper	0.93-[1]
Miscellaneous labor—	
Gang foreman—first class	1.03-[1]
Gang foreman—second class	0.98-[1]
Rigger—first class	0.94(0.93-0.95)-[2]
Rigger—second class	0.96-[1]
Rigger—helper	.....
Maintenance man	0.96(0.87-1.06)-[6]
Third helper	0.95(0.94-0.97)-[4]
Fourth helper	0.91-[2]
Crane operator	1.09(1.05-1.13)-[2]

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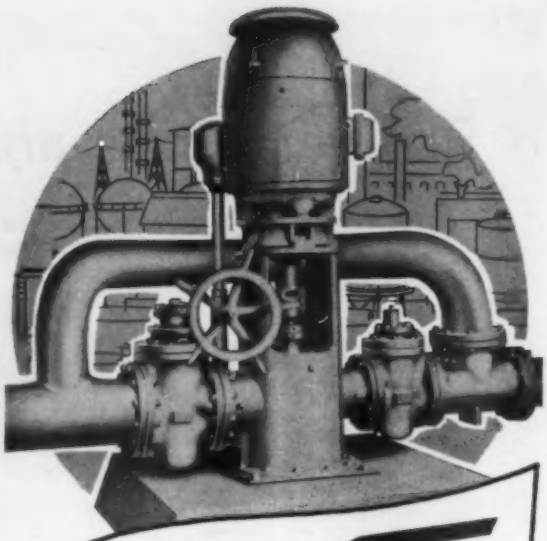

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Refinery Jobs and Wage Rates (Continued)

Category—	Ratio to avg. wage of workers*
Crane op. helper	0.98-[2]
Utility labor	0.90-[1]
Maint. labor	0.83(0.77-0.86)-[5]
Maint. labor—second class	0.78(0.68-0.81)-[6]
Casual labor	0.78-[3]
Tractor operator	0.96(0.93-0.98)-[2]
Bulldozer operator	1.03(1.01-1.05)-[2]
Boiler washer	0.97-[1]
Tower cleaner (trays)	0.99-[1]
Reactor cleaner	0.33-[1]
Tube cleaner	0.92-[1]
Catalyst mixer	0.88-[1]
Catalyst loader	0.87-[1]
Fire equip. man	.....
Fire equip. helper	.....
Hoisting engineer	1.03-[1]
Truck driver (winch)	1.00-[1]
Truck driver under 2½-ton	0.90(0.81-1.05)-[8]
Truck driver over 2½-ton	0.88(0.82-0.94)-[2]
Truck driver helper	.....
Pipeliner, first class	0.86-[1]
Pipeliner, second class	0.81-[1]
Utilities:	
Power-house engineer	.....
Water-station engineer	.....
Water-station helper	.....
Boiler fireman	0.94(0.88-1.00)-[5]
Boiler operator	1.05(0.99-1.09)-[3]
Boiler helper	0.92(0.88-0.96)-[2]
Water tender or treater	0.97(0.94-1.00)-[2]
Elec. power operator	0.96(0.88-1.05)-[2]
Elec. power helper	0.93(0.88-0.99)-[2]
Water pumper	0.86-[1]
Cooling-tower operator	.....
Air-compressor operator	.....
Water-softening operator	.....
Power-house oiler	.....
Power-house electrician	.....
Power foreman	.....
Shipping, Receiving, and Storage:	
†Supt., receiving and shipping	.....
†Mgr., warehouse	.....
†Mgr., marine loading	.....
†Supervisor, receiving and stores	.....
Storekeeper chief	.....
Stock foreman or keeper	1.05-[1]
Warehouse record clerk	.....
Material (stock) clerk	0.92(0.88-0.97)-[2]
Inventory clerk	.....
Dispatcher	.....
Receiving clerk	.....
Shipping clerk	1.10-[1]
Shipping checker	1.01-[1]
Tool clerk and foreman	.....
Tool clerk	0.92-[2]
Order filler	.....
Barrel weigher	.....
Stenciler	0.97-[1]
Stenciler helper	0.92-[1]
Head barrel filler	.....
Head can filler	.....
Yardmaster or head loader	1.22-[1]
Head wharf tender	.....
Traffic manager	.....
Terminal superintendent	.....
Can capper	.....
Can conveyor feed	.....
Container washer	.....
Warehouseman	0.98-[1]
Nailing-machine operator	.....
Drum-plant filler	1.00-[1]
Floorman, compounding	1.03-[1]
Caser	0.97-[1]
Asphalt switching	.....
Package fillers—hand	0.87(0.80-0.93)-[2]
Package fillers—machine	0.84(0.80-0.89)-[2]
Locomotive fireman	.....
Locomotive crane operator	.....
Crane follower	.....

Category—	Ratio to avg. wage of workers*
Head transport loader	1.07-[1]
Rackman (also see loaders)	0.91(0.85-0.94)-[4]
Rackman helper	.....
Switch tender	.....
Brakeman	.....
Elevator op., freight	.....
Trucker, hand	.....
Truck driver, under 2½ tons	0.90(0.81-1.05)-[8]
Truck driver helper	.....
Truck driver, over 2½ tons	0.91(0.82-1.00)-[3]
Loaders (rail cars and trucks)	0.96-[1]
Hvy.-oil loading rack—	
Loader	1.10-[1]
Blender and helper	0.98(0.95-1.00)-[2]
Lt.-oil loading rack—	
Chief loader	0.98(0.97-0.99)-[2]
Senior clerk	0.99-[1]
Pumper or top loader	0.97(0.96-0.98)-[2]
Ground man or helper	0.90(0.88-0.91)-[3]
Gager	0.98(0.98-1.00)-[2]
Boat loader	.....
Boat loader helper	.....
Dock loader (truck)	0.92(0.89-0.97)-[4]
Container repairman	.....
Container repair labor	.....
Container inspector	.....
Drum conditioner operator	1.00-[1]
Drum conditioner asst.	0.97-[1]
Drum conditioner helpers	0.90(0.88-0.92)-[2]
Car (railroad) inspector	1.05(1.01-1.10)-[2]
Tank-car repair—	
Air brakeman	1.09-[1]
Steam coil	1.05-[1]
Repairman—foreman	1.05(1.01-1.09)-[2]
Second helper	1.03-[1]
Third helper	0.97(0.94-0.98)-[3]
Fourth helper	0.91-[1]
Labor	0.87-[1]
Cleaner	0.91-[1]
Boxmaker	.....
Box printer	.....
Cooper	.....
Painter, barrel or container	.....
Painter, spray	.....
Painter, helpers	.....
Salvage foreman	1.00-[1]
Salvage man	.....
Salvage helper	.....
Reclamation inspector	.....
Garageman	.....
Fork-lift operator	0.92-[1]
Protection and Custodial Service:	
†Personnel and safety director	.....
†Safety and training supervisor	.....
†Physician, industrial	.....
†Nurse, industrial	.....
†First aid attendant	.....
†Superintendent, protection	.....
Guard sergeant	.....
Guard captain	.....
Guards (roundsmen)	0.88(0.83-0.93)-[2]
Gateman	.....
Watchmen	0.85(0.83-0.87)-[3]
Fire marshal	.....
Fire inspector	.....
Firemen	.....
Janitor	0.77(0.68-0.86)-[6]
Charwoman	.....
Porter	.....
Groundskeeper	.....

*Numbers in brackets indicate the number of refineries reported. †Usually salaried employes.

Water scarce? Try air cooling

The chemical industry is lagging in adopting air-cooled exchangers, this author believes. In applying them to chemical plants some problems have been encountered, but solutions do not appear insurmountable. Here's a discussion of the problems.

ON A PROJECT BASIS when 75% of the heat can be removed above a 25° F. approach to the design air temperature, and allocated costs for water facilities are $50 per g.p.m. or higher air-cooled exchangers offer attractive possibilities and warrant further investigation. Careful analysis should be given to the selection of the design air temperature.

Application Guide

Table 1 provides some practical guidance to the areas where individual air-cooled exchangers should be investigated further and the design conditions under which they may prove economically attractive.

Several design conditions appear to have a large effect on the economic selection of air-cooled exchangers.

Operating costs . . . The design conditions outlined in Table 1 will affect the total investment cost of air or water-cooled exchangers. Operating costs should be determined separately for comparative evaluations. However, as a quick guide, the design conditions listed in Table 1 which are favorable to air cooling on an investment basis will usually indicate favorable operating costs.

The operating costs which will have a controlling effect on evaluations of air versus water-cooled exchangers are maintenance and cleaning of exchangers, power costs for air-cooler fans, and water-supply, treatment, and disposal costs.

As a guide, a ratio of approximately 4 to 1 for cleaning and maintenance costs is suggested for water versus air-cooled exchangers, when detailed cost records are not available. This ratio will probably increase for brackish or contaminated water and decrease for clean water.

The major out-of-pocket operating cost for air-cooled exchangers is for electric energy for fan motors. The total rated horsepower of the fan motors of an air-cooled exchanger is not a reliable indication of the annual power consumption. Except for air-cooled exchangers with one fan and a single-speed motor, the average power requirements are considerably less than the total rated motor capacity. If two-speed motors are used, the half-speed fan air flow will be 50% of full-speed flow and the fan power will be one-eighth of full-speed power requirements. Therefore, where the air flow can be reduced to 75% or less for a large percentage of the year, two-speed motors will result in substantial power savings. Power savings can also be realized by the use of automatic controllable-pitch propeller fans.

Heat-transfer design conditions . . . The outlet process temperature, design air temperature, and log mean temperature difference will have a large effect on the size of an air-cooled exchanger. A small LMTD and close temperature approach can result in considerable exchanger surface, air flow, and fan horsepower per 1,000,000 B.t.u. per hour of heat removed. Analysis of process conditions may indicate that outlet fluid temperature, normally used with water cooling, cannot be economically justified. The design dry-bulb air temperature should not be the maximum temperature of record for the area but the temperature which can be exceeded for a reasonable number of hours per year.

The conventional horizontal air-cooled exchanger is most economical when the tube length is 24 ft. or longer. A process-side pressure drop of less than 1 psi. is costly. For more economical design, a pressure drop of less than 1 psi. per pass should not be specified.

Dirt on the air-side extended surface of an air-cooled exchanger—unless it restricts air flow—has no appreciable effect on heat transfer. While the transfer coefficient on the water side of the water-cooled exchanger is considerably greater than air, fouling factor corrections for actual cooling-water conditions reduce this advantage.

Process-side coefficients below 200 B.t.u./hr./sq. ft./°F. referred to the outside bare-tube area usually result in air-cooled exchangers with total heat-transfer surface favorable with water-cooled exchangers on a comparative cost basis.

Cooling method . . . Where the air-cooled exchanger replaces a water-cooled type and can be located close to the process equipment, it has its best economic advantage, as compared with water cooling. When the process heat is transferred in some type of heat-exchanger device to a secondary fluid which is then cooled by flow through the air-cooled exchanger, the investment and operating savings will be less attractive.

Materials of construction . . . Materials of construction must satisfy both the process and water-side requirements for water-cooled exchangers However, for air-cooled exchangers only the process-side requirements are controlling.

Process temperature control . . . Outlet-process temperature-control requirements will considerably affect the design and cost of an air-cooled exchanger. Three general types of temperature control are required: (1) Maximum cooling at all times with no freezing problem of the process fluid. (2) Close control of the outlet process temperature. (3) Close control of the outlet process temperature and a high freezing point of the fluid.

Design air temperature . . . When close process outlet temperature approach to the dry-bulb temperature is required in an air-cooled exchanger application, careful analysis of effect on process

Condensed from paper presented by R. T. Mathews, engineering department, E. I. du Pont de Nemours & Co., at AIChE meeting, Cincinnati.

TABLE 1—APPLICATION GUIDE FOR AIR-COOLED HEAT EXCHANGERS

The values listed in this table are estimated limits for the items considered and may be used either individually or collectively. As a guide, if 10 favorable items are listed in Columns 1, 2, and 3 for an air-cooled heat exchanger under consideration, further investigation is advisable. At least five of the favorable items should be those shown with an asterisk.

		Design conditions for water or air-cooled exchangers which determine the economic selection			
	Justification for selection—	Lower project investment or lower operating costs	Savings in allocated facilities plus savings from Column 1		
	Economics of air cooling—	Column 1 Attractive	Column 2 Attractive	Column 3 Favorable	Column 4 Marginal or unfavorable
*1	Allocated facilities, $/g.p.m.	..	100	50	25
*2	Temperature approach, °F. (a)	50	50	25	15
*3	LMTD, °F.	125	100	75	30
*4	Water-side fouling factor	0.003	0.002	0.001	0.0005
*5	Process-side heat transfer coefficient (b)	1-150	1-200	200-400	400-1,000
*6	Process-side pressure drop, psi.	10	10	1	0.1
7	Water temperature rise, °F.	10	10	25	40
8	Design pressure, psia. (c)	Above 1,000	Above 500	Above 15	Below 15
9	Design temperature, °F.	Above 400	Above 300	Above 200	Below 150
*10	Cooling method	Process cooling	Process or intermediate fluid cooling (d)	Process or intermediate fluid cooling	Intermediate fluid cooling
*11	Materials of construction:				
	Water-cooled exchangers	Bimetallic tubing or special materials because of water side	Bimetallic tubing or special materials because of water side	Bimetallic tubing or special materials because of water side	Materials the same for either exchanger
	Air-cooled exchangers	Materials required only for process side conditions	Materials required only for process side conditions	Materials required only for process side conditions	Materials the same for either exchanger
12	Design air temperature, 0° F. (f) and (%) exceeded annually	85-(3%)	90-(2%)	95-(1%)	100-(0.1%)
13	Temperature control	Manual	Manual	Automatic	Automatic
*14	Process freezing temperature, °F.	Below 0° F.	Below 0° F.	32° F.	100° F. or higher
*15	Cleaning process side (e)	None required	Clean fluid	Chemical cleaning	Hand cleaning
16	Recirculation—downdrafts from structures	None	None	Possible	Poor conditions
17	Structural supports	Ground-mounted	Ground-mounted	No structural difficulties	Special structures
18	Length of process piping	Short	Short	Medium	Long
19	Length of water piping and sewers	Long	Long	Medium	Short

(a) The use of water-cooled exchangers in series with an air-cooled exchanger is often more economical than complete air coolers. As a guide, if 75% of the process heat can be removed above 150° F., air cooling should be considered.

(b) Process-side heat-transfer coefficients below 200, including process-side fouling factor, usually favor air cooling except clean fluids where extended surface can be used on the process side. Heat-transfer coefficients are all referred to the outside surface area based on the bare-tube outside diameter.

(c) Air-cooled exchangers are usually more economical than drip coolers for design pressures over 1,000 psi.

(d) "Process cooling" is used to define those cases in which the process fluid is actually cooled by flowing through the air-cooled exchanger.
"Intermediate fluid cooling" is used to define those situations in which the process heat is transferred in some type heat-exchanger device to a secondary fluid which is then cooled by flow through the air-cooled exchanger. (Cooling of jacket water for engine and compressor cylinders would be classified as intermediate fluid cooling.)

(e) When frequent process-side cleaning, which cannot be done by chemicals, is necessary, conventional air-cooled exchangers should be avoided, unless removable coverplates are used and special provision made for hand cleaning.

(f)

Plant—	Maximum dry-bulb temp., °F.	Dry-bulb temp., °F., % of annual hours stated temperature is exceeded 1%	2%	3%	Annual average dry-bulb temp., °F.	Suggested design temp., °F.
Beaumont, Tex.	102	93	91	90	69	91
Victoria, Tex.	110	98	96	95	71	96
Parkersburg, W. Va.	106	90	87	86	55	87
New Orleans	102	92	91	89	70	91
Wilmington, Del.	106	88	85	84	55	85
Grand Rapids, Mich.	99	83	80	78	47	80

1% = 88 hours. 2% = 175 hours. 3% = 263 hours.

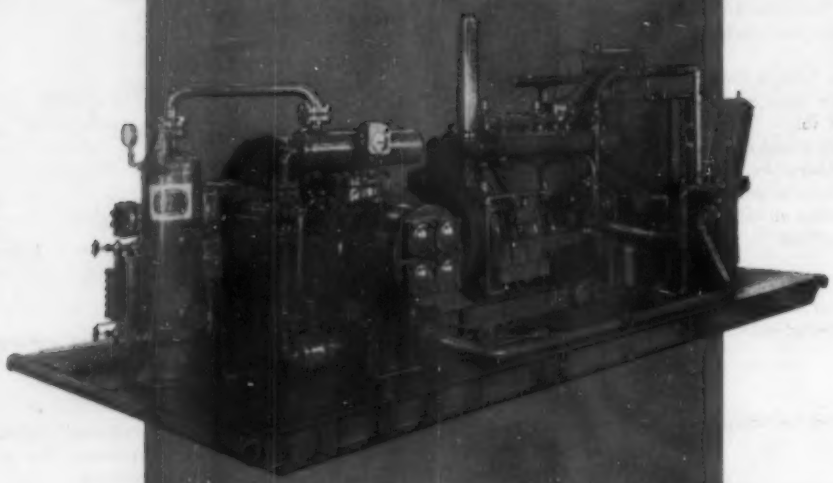
THE

INGERSOLL-RAND

CONTROLLED CLEARANCE

"LINER TYPE" LOW STAGE

COMPRESSOR CYLINDER



means a

MORE FLEXIBLE

WILSON SUPPLY—INGERSOLL-RAND PACKAGED COMPRESSOR UNIT

With "controlled clearance" this cylinder is capable of handling any application where the discharge pressure is between 150 lbs. and 500 lbs. It is necessary only to change liners and/or clearance.

This new cylinder gives sustained high efficiency and trouble-free performance through the use of Ingersoll-Rand Type "A" channel valves.

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conditions of exceeding design temperature is required.

Ambient air temperatures, except for short periods, will usually be lower than cooling-tower and some river-water temperatures. This is illustrated in Fig. 1, which shows a plot of annual temperature probability curves for a plant location.

The cooling-tower curve is based on manufacturer's performance data, but does not include any allowance for higher outlet-water temperature due to recirculation.

Economic Evaluation

The short-term basis of economic evaluation reflects current project investment and potential operating-cost savings. Allocated investment in excess capacity in existing pumping facilities, distribution water lines, and sewers are given little weight in an evaluation, as these facilities represent money spent, and remaining cooling-water capacity is considered free of charge. Only when new facilities are required are they included in the evaluation.

The long-term economic evaluation reflects current project investment, as well as long-range investments in water facilities, and anticipated operating costs. It recognizes that unless an allocated cost for investment in pumping facilities, distribution lines, and sewers is charged against each water user, these facilities may be quickly expended and more facilities will have to be built.

Table 1, Column 1, allows selection of air-cooled exchangers on a short-term basis, while Columns 2, 3, 4 are provided when the long-term basis of evaluation is considered.

An important index in the economic comparison of air instead of water cooling on a complete project basis is the percentage of the total heat removed above a process-outlet temperature equal to the selected dry-bulb design temperature plus 25° F. If this percentage is 75% or greater, and the allocated costs for water facilities are $50 per g.p.m. or higher, air-cooled exchangers offer attractive possibilities and warrant further investigation. Although individual air-cooled exchangers may appear marginal in certain cases, more than compensating economies may be realized by maximum reduction of investment in cooling-water facilities, water piping, and sewers.

Problems of Air Cooling

There are several problems related to the use of air as a cooling medium.

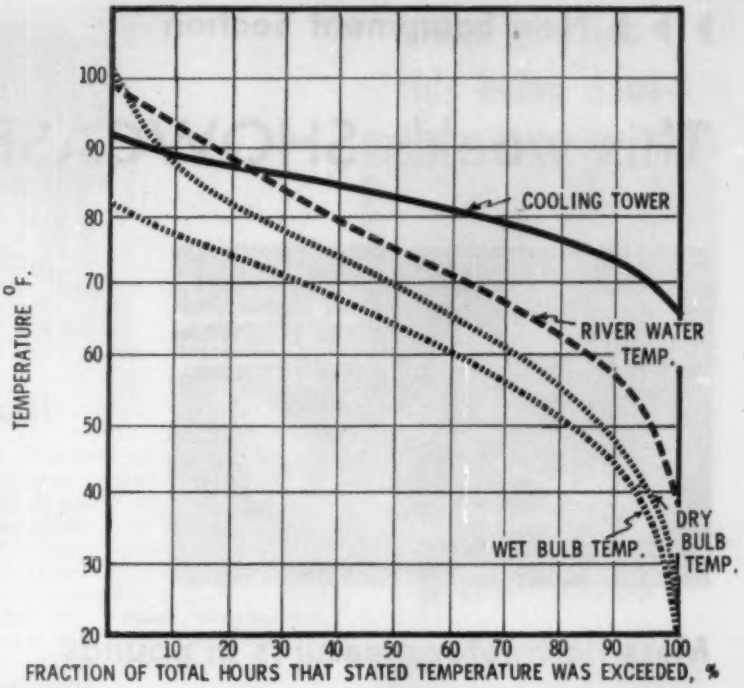
Atmospheric corrosion . . . Care should be exercised that air coolers are not placed where corrosive vapors and fumes from vents or stacks will pass through them.

Fire hazard . . . A fire hazard can exist from leakage of chemicals into the air stream.

Toxic-fumes hazard . . . A hazard can occur from leakage of toxic fumes. The large air flow through the air-cooled exchanger should greatly reduce the concentration of any normal leak of toxic fluids.

Maintenance and cleaning . . . When hand cleaning is necessary on the process-tube side, and the rated pressure is above about 150 psi., special designs should be considered.

Lower outlet-process temperatures . . . When lower outlet-process temperatures are required than can be obtained with air cooling, three solutions are available. These are: final cooling by water, evaporative cooling, or air-cooled refrigeration, depending on the economics of the cooling-water supply.



ANNUAL TEMPERATURE PROBABILITY CURVES for a plant location. Fig. 1.

New Design Requirements

Current designs available from manufacturers can be used for many process applications. The effective and full use of air cooling will not be realized, however, until new designs are developed more adapted to the needs of the chemical industry.

Requirements of new designs are: reduced space requirements, temperature and sound control, maintenance and cleaning, and extended surface for high temperature. The extent to which these design requirements are necessary will vary with each application.

Reduced space requirements . . . This can be realized by the use of suspended fan drives, higher static-pressure fans, and in some cases elliptical tubes to provide a more compact exchanger.

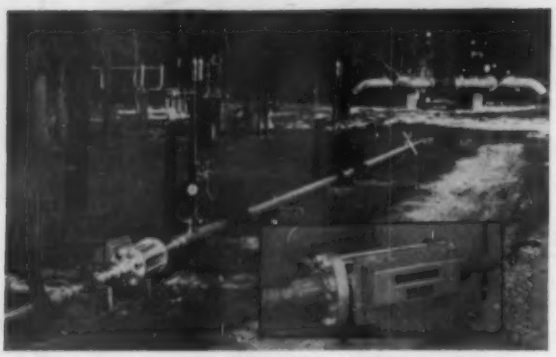
Temperature control . . . The air-cooled exchanger will require more careful design to give close control of process temperature, protection of coils against rain and hail, and controlled recirculation of warm air to avoid freezing of high-temperature melting-point fluids.

Extended surface for high temperature . . . More technical data are needed on various types of extended surface for process fluids at higher temperature.

Maintenance and cleaning . . . Easier methods of cleaning the tubes on the process side are required for some chemical applications.

Sound control . . . The noise from propeller fans can become an industrial nuisance if careful consideration is not given to sound control in the air-cooled exchanger design.

This week's SHOWCASE features . . .



Mass flowmeter measures in pounds

. . . of gas or liquid directly. The recently developed meter is expected to be available early in 1960. Meantime prototype production units will be field-tested in natural-gas service. The meter promises to be valuable for measuring gas at the wellhead and in pipeline gathering, transmission, and distribution.

The flowmeter senses mass directly, requires no in-between calculations, and is self-contained, lightweight, and designed for long operation without maintenance. Sustained accuracy is maintained under variable flow conditions.

The meter is designed to emit a series of electrical pulses. Each pulse represents a given weight of flow. This signal can be used to operate remote recording, dispatching, and accounting systems.

The meter will handle a wide range of fluids besides natural gas. These include naphtha, gasoline, LPG, oxygen, and nitrogen. Components include a small gyroscope that directly and automatically totalizes flow and a flow rate sensor that consists of a constant-speed impeller and a stationary turbine arranged for axial flow. Torque exerted on the turbine is proportional to mass flow rate. The gyro integrates the torque with respect to time. Output is continually summed on a cyclometer dial in pounds. **Contact Manufacturer: Black, Sivalls & Bryson, Inc., 7500 East Twelfth Street, Kansas City 26, Mo., for details on mass flowmeter.**

Map projector simplifies drafting

. . . of oil-industry maps. The new device, called Mapograph, is an opaque projector that permits you to bypass photostats and eliminates the use of dividers or other conventional techniques. Information from tracings can be hand-copied. The problem of shrinkage common to wet processes and consequent loss of scale accuracy is done away with.

Vertical in design, the projector needs no floor space and allows you to make use of overhead dead space. A front-surface mirror of high reflecting power picks up the copy which is lighted by four 150-watt lamps. The unit takes any roll map, opaque or transparent, up to 54 in. wide. The price complete and ready for use is $597 f.o.b. factory. **Contact Manufacturer: J. A. Engel, Inc., 4837 Emerson Avenue, South, Minneapolis 9, for details on Mapograph.**

●

High-strength polished rods

. . . now being produced are made of AISI C-1050 steel, a piston type of steel with a yield strength of 85,000 to 105,000 psi., tensile strength of 100,000 to 120,000 psi., and 20% minimum elongation in 2 in.

Three standard sizes and lengths with four pin sizes are available. The ten size combinations available range from 1⅛ in. by 11 ft. with 15/16-in. pins to 1½ in. by 22 ft. with 1⅜-in. pins. **Contact Manufacturer: National Supply Co., Two Gateway Center, Pittsburgh 22, for details on high-strength polished rods.**

Send this **Showcase Coupon**

to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

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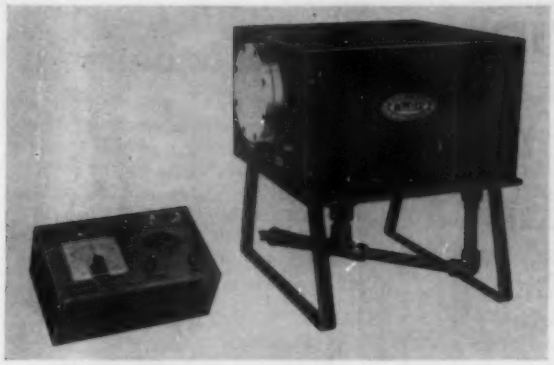
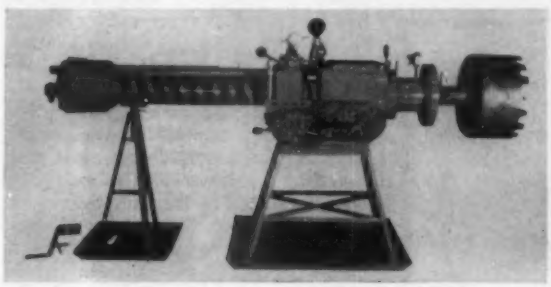


Meter to test aircraft fuel

. . . for contamination using twin photometric tubes has been developed. The instrument monitors its own accuracy. One tube evaluates a sampled stream of fuel in transfer against a continuous clean sample of the same fuel. Any difference in reading is considered attributable to and recorded as contaminant.

Called a purity meter, the test instrument can be used to monitor the cleanliness of fuel during any transfer or delivery operation. If desired, it can be used to activate an alarm system or to shut off flow.

The meter detects contaminants quantitatively by measuring the light as it is scattered by solids or by water in the fuel. **Contact Manufacturer: Bowser, Inc., 1300 East Creighton, Fort Wayne, Ind., for details on Purity meter.**



High-pressure pipe-tapping machine

. . . is now available in two models. The Mark I unit comes with either an air motor or hand-crank power and covers the range of high-pressure taps from 1 to 6 in. It uses twist drill cutters for diameters up to 3 in. and shell-type cutters for diameters up to 6 in.

The Mark II unit uses air or hydraulic power coupled with the shell cutters to provide cuts from 4 to 16 in. in diameter.

The shell cutters provide clean cutting. The replaceable teeth, shell, and backplate are designed for easy field maintenance by operating personnel. The center of gravity of the tapping units is well forward, near the cutting end of the machine for easy handling.

The machines can be used in a vertical or horizontal position due to built-in lifting rings and bail. They are designed for hot tapping all oil, gas, and product lines. They may also be used for all types of vessels, such as refinery and chemical processing tanks that operate under pressure. **Contact Manufacturer: F. H. Maloney Co., 2301 Texas Avenue, Houston, for details on Mark I and II hot-tapping machines.**

•

Extra-strong tape coating

. . . is now being made of high-density polyethylene. It is a cold-applied tape coating for transmission pipelines. Application is by tensioned-spindle equipment.

Under a supervised field test, 50,000 squares were applied to over 300 miles of pipeline. The No. 960 tape is tougher, more heat-resistant, but with the same stability and electrical and water-insulation properties as con-

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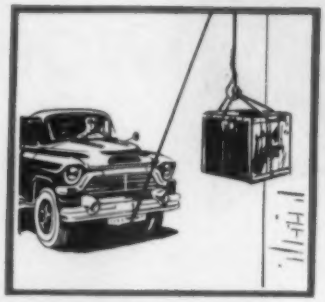
a NEW BRADEN winch for the NEW FORD

4 wheel drive truck



BRADEN MODEL LU2-15 — a front end winch kit for the FORD F100 and F250 (4x4). Completely equipped with base angles and cable roller assembly to adapt to frame extensions for the truck, and all driving parts. This compact, lightweight winch has a safe working load of 8,000 lbs., and greatly adds to the usefulness of this new, versatile FORD truck.

The BRADEN LU2 model is also available in kits for ½ and ¾ ton (4x4) Chevrolet, Dodge, International and GMC trucks. The same type quality materials and workmanship, found in heavier winches, have gone into making this compact, easy to-operate winch. Write for information on the models you are interested in.

Replacement parts are available through BRADEN distributors or from factory

BRADEN WINCH COMPANY
P.O. Box 547, Broken Arrow, Oklahoma

BRADEN Winches

In service around the world

SHOWCASE . . .

New Equipment

ventional Polyken tapes. It requires no primer, no drying or cooling time, gives off no fumes, causes no fire hazard, and, according to the maker, it provides low installation cost. **Contact Manufacturer: Polyken Sales Div., Kendall Co., 309 West Jackson Boulevard, Chicago 6, for details on No. 960 tape coating.**

●

Portable two-way radiophone

. . . is now being produced that is designed to block out annoying interference caused by other radio systems on a user's channel. Called Private Line, the radio works on a tone-coded squelch principle. The transmitters in a system generate an inaudible coded tone which is transmitted along with the voice message. This tone is detected by a tone-sensitive relay in the system's receivers. Incoming messages are blocked from the receiver's audio circuit unless the coded tone is present. Consequently, messages from other systems on the channel are normally not heard.

The portable radiophone comes in low and high-powered versions in both the 25-50 mc. and the 144-174-mc. frequency bands. It can be operated from dry-cell or nickel-cadmium battery packs. Weights vary from 7 to 18 lb., depending upon the power and battery type. **Contact Manufacturer: Motorola Communications and Electronics, Inc., 4501 West Augusta Boulevard, Chicago 51, for details on radiophones.**

●

12-in. extruded plastic pipe

. . . is now being produced in Schedules 40 and 80 types. Fabricated plastic fittings are also available for the 12-in. pipe. The makers standard stock length is 20 ft. But longer lengths can be obtained. **Contact Manufacturer: Joseph T. Ryerson & Sons, Inc., Box 8000-A, Chicago 80, for details on 12-in. plastic pipe.**

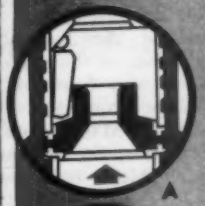
LARKIN FILRITE CEMENTING EQUIPMENT

For automatically filling the casing from the bottom while casing is being run.

The prime functions of Larkin Filrite Cementing Equipment are:

1. To eliminate the "piston-effect" of pressure surges which occur when closed-end casing is being lowered. This reduces the hazard of breaking down weaker formations.

2. To speed up the casing run by eliminating time-consuming surface fill-up of the casing. Uninterrupted lowering of the casing reduces the possibility of casing becoming stuck before reaching bottom.

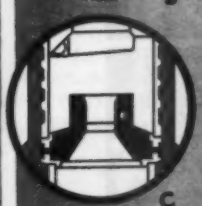


A

Circle A, a view 90° from that of the large illustration, shows the Filrite valve in running-in position. The resilient diaphragm valve remains closed until the differential fluid pressure across it overcomes its inherent resistance to open.

B

Circle B shows the rubber diaphragm inverted by pump pressure as the well is being cemented. Filrite is full opening and will allow passage of a bridging to actuate other equipment which might be installed on the casing beneath a Filrite Collar.



C

Circle C shows the spring-loaded flapper valve in closed position after being released by inversion of the diaphragm. The flapper valve in the Larkin Filrite equipment is very strong and has no depth limitations.

Available but not illustrated:

Filrite Collar, Filrite Geyser Shoe and Filrite Geyser Collar

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LARKIN LEADERSHIP HAS BEEN EARNED BY YEARS OF DEPENDABLE PERFORMANCE

OBJECTIVE •• OIL

If oil or gas production is your objective, your equipment takes on an unusual importance. In few operations do safety and economy mean so much. High financial risks are linked with the problem of keeping high pressures in place to protect not only the equipment itself but important reserves and trained personnel. This is the big reason so many successful operators COUNT ON CAMERON when the objective is oil. They know that only the best available pressure controls for drilling and producing (blowout preventers, valves, gauges, and relief valves—Xmas trees) will give them the best chance for success. If your objective is oil — no matter where you are looking for it — Cameron controls are available to help you succeed. World-wide sales representation is conveniently located to serve every major oil producing area of the free world.

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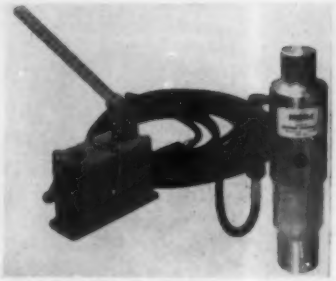
SHOWCASE . . .

New Equipment

Brass insulating tee

. . . has just been put on the market that employs a compression sealing principle. It can prove useful in place of malleable street tees on cast-iron gas mains where excessive corrosion is a problem as it is cathodic to cast-iron pipe and insulated from the steel service lines. It thus gives positive insulation between the two.

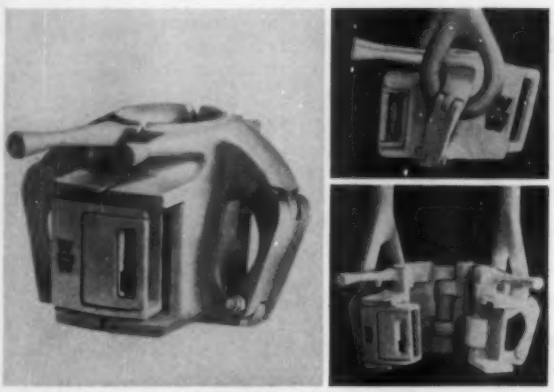
The Style 90 tee meets ASA standard B16.15, 1947 for brass fittings. It comes in 1¼-in. sizes. **Contact Manufacturer: Dresser Mfg. Div., Dresser Industries, Inc., Bradford, Pa., for details on Style 90 tee.**



Hydraulic wire-line stripper

. . . now in production can be used to replace manually operated oil savers and the possible dangers incurred in their use as it can be remotely controlled, keeping personnel away from the wellhead during swabbing operations.

Two models of the Double E stripper are available. Model C is made in 2 and 2½-in. sizes and Model CL in 2½ and 3-in. sizes. The rubbers are tightened around the swab line by operating the hydraulic pump mounted either on the pulling unit or some place away from the wellhead. Prices range from about $145 to $190. **Contact Manufacturer: Equipment Engineers, Inc., Dallas, for details on Double E linestripper.**



Compact center-latch elevators

. . . are now being produced with greater compactness than previous models. Yet they allow more clearance for the installation of links. A slanted hinge pin is used to give the elevators a natural tendency to close under load.

A strong coil spring is located at the hinge pin that opens the elevator and forces it away from the pipe when the safety latch is released. This spring also maintains the elevator in a fully open position until it is latched again.

The latch assembly is built into the body where it is free from accidental opening and protected from external damage. A large rear handle eases movement of the elevator about the pipe. Tradenamed Champion, the elevators can be obtained in all popular outside-diameter sizes for both collar and 18°-taper types. Elevator capacities range from 100 to 350 tons. **Contact Manufacturer: Web Wilson Oil Tools, Inc., P. O. Box 72096, Los Angeles 2, for details on elevators.**

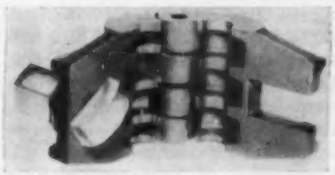
SHOWCASE . . .

New Equipment

Thick-jointed aluminum pipe

. . . is now available in a complete range of Schedule 40 equivalent sizes. The walls of the heavy-end pipe are tapered in thickness to provide extra strength at the joints while eliminating excess metal in the pipe body. Available in 30 and 40 ft. lengths, the pipe can be used interchangeably with other standard aluminum pipe. **Contact Manufacturer: Reynolds Metals Co., Dept. PRD-11, Box 2346, Richmond 18, Va., for details on H-E pipe.**

●



One-bolt polish-rod clamp

. . . with T-head bolt is now available in all standard polished-rod sizes. The T-head bolt lets you remove the clamp quickly and easily. The nut can be reached from any angle and provides ample contact area for security as well as a wide wrenching area.

Called the Wonbolt, Sr., the clamp sits flat on either end. It makes full-circle contact with the rod at the top and bottom and at staggered intervals. Tightening the clamp does not bend the rod.

The clamp is listed as having a pull-test capacity of 60,000 lb. and a rating of 30,000 lb. It is 4¼ in. high, 6 in. wide, and weighs 13 lb. **Contact Manufacturer: Alten Foundry & Machine Works, Inc., Box 426, Lancaster, Ohio, for details on Wonbolt, Sr.**

●

Automatic aluminum pipe welder

. . . recently announced produces sound welds with full penetration without the use of back-up rings, the maker reports. The unit completes a pass on 4-in. pipe in 11 seconds.

The welder can process all tubular products with outside diameters from 4 to 11 in. Mechanically operated clamps grip the pipe during welding. They are adjustable, making the machine capable of welding the new variable-wall aluminum pipe. **Contact Manufacturer: Aluminum Co. of America, 1501 Alcoa Building, Pittsburgh 19, for details on automatic welder.**

Optimal-mode process controller

. . . just introduced controls on the slope of the characteristic curve of a process rather than at some fixed point such as temperature. Unlike the original models which held control at any slope on the process curve, the Model 760-W controls only for zero slope, offering a choice of a maximum or a minimum.

This simpler model is designed for control problems not requiring the more complex control on slopes other than zero. Control is on a unit process basis rather than an all-inclusive plant. Each controller has a single output. It changes a single process input variable. For two or three process inputs, the controllers can be paralleled or time-shared. Controller input may be made up of as many variables as needed to get the required result. **Contact Manufacturer: Quarie Controllers, Box 95, Canton, Mass., for details on Model 760-W controller.**

●

Truck winch powered by battery

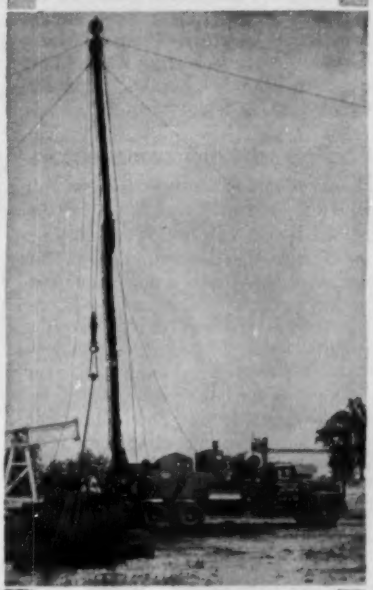
. . . is now available that can lift 3,000 lb. using multiple lines and 1,000 lb. with a single line. Motor voltage can be 6, 12, or 24 volts d.c.

Features include a quickly detachable remote-control cable with two-way switch, drum capacity of 225 ft. of 5/32-in. 2,800-lb. test cable, a self-energizing brake, folding swing boom, and telescoping A-frame.

The Little Tiger winch offers a way to increase truck use, decrease labor costs for unloading and loading trucks, and prevention of injuries due to manual lifting. **Contact Manufacturer: Tiger Manufacturing Co., 3369 Cherry Avenue, Long Beach 7, for details on battery-powered winch.**

WICHTEX
WELL SERVICING UNITS

BUILT TO STAND UP!



Wichtex Units are designed and built to save you repair bills and downtime. Owner after owner has testified that these units "beat anything else in the field" for long, hard service without repairs. Long trouble-free life . . . plus fast, easy, efficient operation . . . make Wichtex Units outstandingly profitable to own. Investigate:

WICHTEX WELL SERVICING UNITS
2,000′ to 12,000′ capacity
(spudding attachment optional)

WICHTEX PORTABLE ROTARY RIGS
2,000′ to 5,000′ capacity

WICHTEX MACHINERY COMPANY
P. O. Box 2250
WICHITA FALLS, TEXAS

SHOWCASE . . .

New Literature

Miniature secondary indicator

. . . for liquid-level measurement is described in Bulletin WG-1824, Supplement B, yours upon request. The two-page literature describes where the indicator is used, how it works, and includes construction details, advantages, weight, dimensions, and an installation diagram. **Contact Manufacturer: Yarnall-Waring Co., Chestnut Hill, Philadelphia 18, for Bulletin WG-1824, Supplement B.**

Packaged field compressors

. . . are illustrated in new 52-page Bulletin 157. The literature fully describes the following features: packaged semi-portable design; vibration-free, balanced/opposed-type compressor; two-cycle, integral gas-engine-driven design; block-type construction for high rigidity; induced vertical air-flow radiator for positive cooling; box-type, heavy-duty skid of highway width; and precision crankshaft and connecting-rod bearings. Engineering data is included for estimating horsepower requirements. **Contact Manufacturer: Clark Bros. Co., P. O. Box 560, Olean, N. Y., for Bulletin 157.**

Rigid-plastic-pipe bulletin

. . . presents questions and answers on ABS (acrylonitrile-butadine-styrene) pipe. Written to provide basic performance and installation facts, the literature lists benefits offered by the pipe when used in oil fields and in other applications. **Contact Manufacturer: Marbon Chemical Div., Borg-Warner Corp., P. O. Box 68, Washington, W. Va., for Rigid Plastic Pipe Made of ABS Polymers bulletin.**

Hydraulic packings Bulletin P-333

. . . which contains specifications and design data on packings that are homogeneous and fabric reinforced, is now available in 16 pages. Information encompasses design, construction, sizes, applications, installation, proper usage, and service and temperature factors for V-rings, U-cups, and piston cups.

A single-page insert on homogeneous wiper rings is also available. Text is accompanied by illustrations, engineering drawings, and tables. **Contact Manufacturer: Crane Packing Co., Dept. OJ-4, 6400 Oakton Street, Morton Grove, Ill., for Bulletin P-333.**

Tool retrieves production packers

. . . as detailed in a new obtainable six-page folder. It covers uses, advantages, operations, instruction, and specifications of several sizes, as well as optional equipment. Diagrams and cutaway drawings are included. **Contact Manufacturer: Bowen Itco., Inc., P. O. Box 4587, Houston 13, for Packer-Retriever folder.**

Automatic production controller

. . . which promises to cut costs of oil-lease operation, is described in a new two-page bulletin. The literature consists of (1) a photo of the controller system—called Pantro—with related information on its component parts; (2) applications and advantages; and (3) an outline of functions which the system controls. **Contact Manufacturer: Control Panel Corp., 517 West Monroe Street, Chicago 6, for Pantro Automatic Production Controller bulletin.**

Combination battery and charger

. . . offers d.c. power for switchgear tripping and control service, as outlined in a new six-page folder. Called AutoCal, the power pack requires virtually no maintenance, the literature reports. Folder AR-102/59 presents mounting information, advantages, performance data, selection charts, and photographs. **Contact Manufacturer: C&D Batteries, Inc., Washington and Cherry Streets, Conshohocken, Pa., for Folder AR-102/59.**

Eight-page machinery pamphlet

. . . in catalog design features milling machines, radial drills, grinders, and lathes. Photos, capacities, specifications, dimensions, applications, and prices are included in the literature with each piece of machinery. **Contact Manufacturer: Aaron Machinery Co., Inc., 45 Crosby Street, New York City 12, for New Machinery pamphlet.**

Pneumatic conveyor recovers catalyst

. . . from cracking towers, reducing refinery down time, as described in new available eight-page Bulletin PB-500. The Hoffco-veyor system for conveying of dry, free-flowing materials, has

POWER
for tough jobs!
BRUTE POWER is what it takes to handle a heavily loaded 90-ton construction barge—and *brute power* is what the Evinrude "Four-Fifty" delivers—quietly, smoothly, day after day. 50 b.h.p. at 4500 r.p.m. New, compact V-4 design. See your Evinrude dealer—he's listed in the yellow pages under "Outboard Motors." Evinrude Motors, 4153 North 27th Street, Milwaukee 16, Wis. *A Division of Outboard Marine Corporation. In Canada: Mfd. by Evinrude Motors, Peterborough*
EVINRUDE outboard motors

numerous applications in all phases of industry, as the literature points out.

It includes advantages of the system, basic system types, installation drawings, and optional equipment. **Contact Manufacturer: Pneumatic Conveying Div., Hoffman Machinery Corp., 103 Fourth Avenue, New York City 3, for Bulletin PB-500.**

Aluminum fittings and couplings

. . . for use with grooved-end pipe are interchangeable and offer simple installation, according to a new four-page bulletin. Size, weight, and dimension charts are contained in Bulletin 100, along with a full-page specifications chart for the malleable-iron fittings. **Contact Manufacturer: Charles E. Manning Co., 4700 Clairton Boulevard, Pittsburgh 36, for Bulletin 100.**

Nondestructive testing apparatus

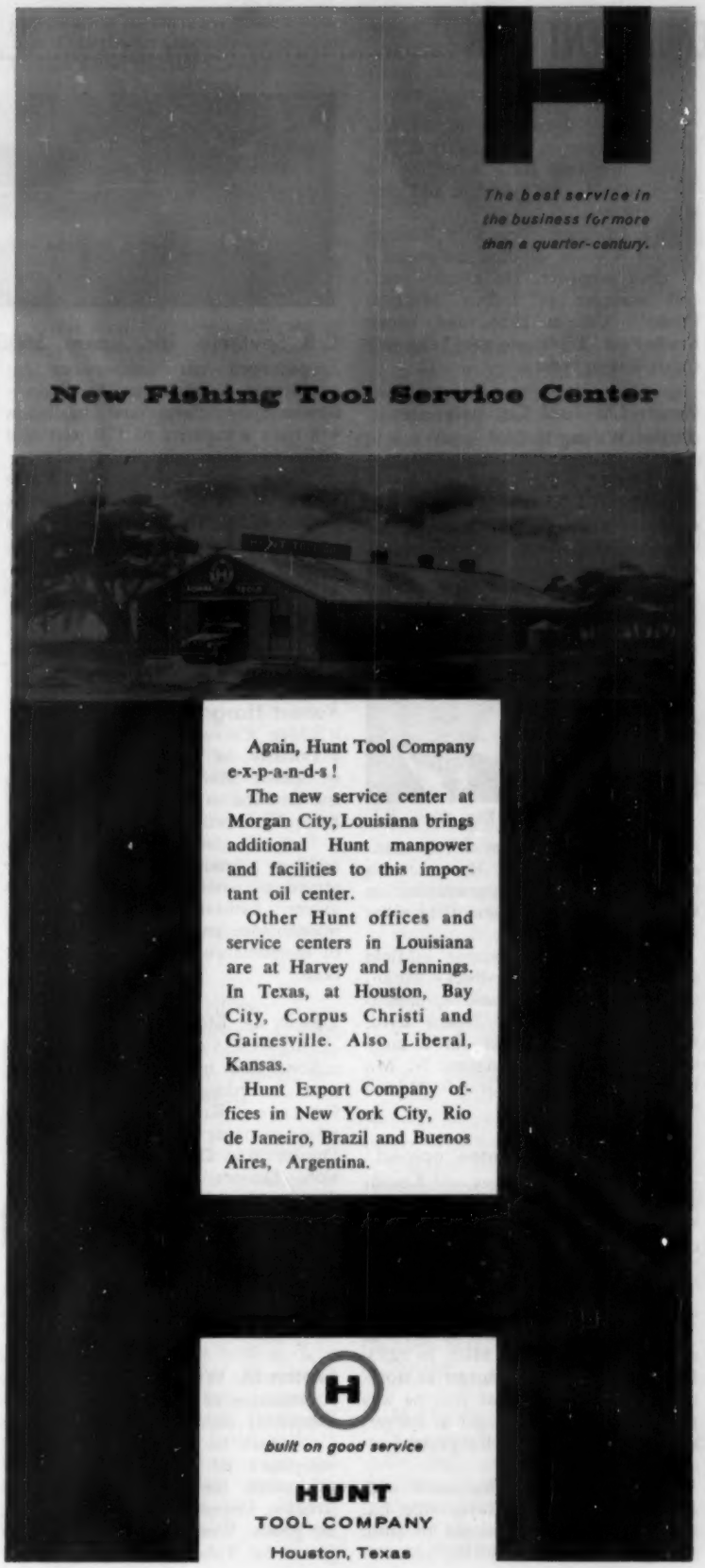
. . . used to test solid materials by induced sonic vibrations is described in a new two-page bulletin. The Sonometer apparatus induces continuous sonic vibrations into samples of concrete, plastic, carbon, metal, and similar materials, and permits comparison of initially induced vibrations and vibrations transmitted through the sample.

The device can be used to measure transverse and torsional-resonant frequencies and strengths. The bulletin features pictures of the device, a block diagram of a typical application, and several examples of the manner in which tests can be performed. **Contact Manufacturer: Soiltest, Inc., 4711 West North Avenue, Chicago 39, for Sonometer Apparatus bulletin.**

Control system and components

. . . for electric drive for oil-well drilling operations are detailed in new Bulletin GEA-6894. The eight-page literature offers detailed information and technical data and points out the simplicity of the electric-drive system.

The bulletin outlines specifications of the control compartment and driller's console, and includes descriptions of the main electrical components and their function. It also provides information on the exciter, electrical cable and connectors, and a connection box for tender-platform rigs. **Contact Manufacturer: General Electric Co., Schenectady 5, N. Y., for Bulletin GEA-6894.**


H
The best service in the business for more than a quarter-century.
New Fishing Tool Service Center
Again, Hunt Tool Company e-x-p-a-n-d-s!
The new service center at Morgan City, Louisiana brings additional Hunt manpower and facilities to this important oil center.
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built on good service
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TOOL COMPANY
Houston, Texas

EQUIPMENT MEN

Joe Terrell is named sales

. . . engineer, specializing in oil-field service equipment, for Stewart & Stevenson Services, Inc., according to Joe Manning, vice president and general manager.

Terrell formerly was with Western Co. for 8 years, holding the position of chief engineer. He became general manager of Luftex Machine Products Co. in 1956, and joined Baash-Ross Tools as chief engineer the following year.

Grant Oil Tool Co. promotes

. . . Rex Walling to field supervisor in charge of branch operations. Walling joined Grant in 1951 after 17 years in geophysical work. He was district manager and division manager at Odessa, Tex. before his new assignment.

Les Hanson

Rex Walling

Succeeding Walling as district manager at Odessa is Les Hanson, who has been a Grant representative in Odessa and in Oklahoma City since 1952.

Robert S. Miller, veteran oil-field supply salesman in the Rocky Mountain area, is now a Grant representative at Casper, Wyo. Nolan Byrd, former branch manager for a large supply firm in Farmington, N. M., has been added to Grant's Odessa staff.

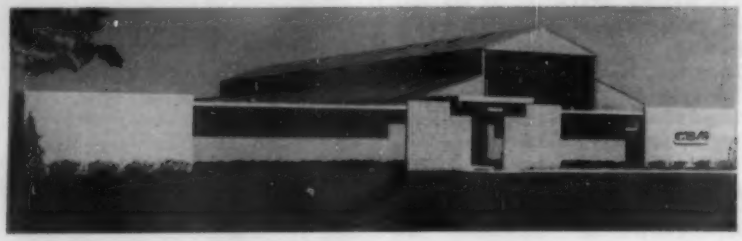
Two new J&L salesmen named

. . . to territories in Texas and Louisiana, announces W. L. Wolfe, J&L Supply Division's vice president in charge of sales.

R. H. Pollakowski goes to Borger, Tex., and R. A. Hammontree takes over at Lake Charles, La.

Pollakowski joined the division as storeman at Reed City, Mich. in 1950. He was transferred to Borger as storeman in 1952. Later that year he was promoted to store manager at Borger, the post he held until his present assignment.

Hammontree began his career with J&L as a storeman at Haynesville, La. in 1951. He was promoted to store manager there the following year.



C-B Southern, Inc. opens $600,000 plant in Houston to build

. . . packaged gas compressors for world-wide distribution. The Cooper-Bessemer subsidiary's new installation will have a capacity of 120 packaged compressors annually.

The plant, located on a 28.3-acre tract with a 360-ft. craneway, covers 36,000 sq. ft. Engineering and sales offices are located in a 5,000-sq. ft. building adjoining the plant.

Here Cooper-Bessemer compressors are mounted on skids designed for each unit and fitted out with all accessory equipment, including closed cooling system, piping, scrubber, and automatic controls—ready for fast, easy coupling to well-head connections.

Thomas E. Kraner, president and co-founder of C-B Southern, comes to the new company from New Orleans, where he was branch manager for Cooper-Bessemer Corp. Co-founder and vice president is Jay L. Cannon. J. E. (Jap) Massey assumes duties as production manager.

Robert Hargrove joins Badger

. . . Mfg. Co. as a project engineer. Previously, he was assistant manager of Socony Mobil Oil Co.'s Engineering Division at the company's Paulsboro, N. J. refinery.

Hargrove began with Socony in 1947 as a student engineer. He later served as assistant maintenance engineer, assistant project engineer, maintenance engineer, and supervisor of maintenance engineering at Paulsboro.

Edwin O. Stafford is promoted

. . . to West Coast regional sales manager, according to Charles Kuhn, sales manager of Dresser Mfg. Division, Dresser Industries, Inc. Stafford, who has served as a Dresser sales representative in the Texas Gulf Coast area since 1956, will headquarter in San Francisco.

E. O. Stafford

Fenton M. Wood is appointed

. . . manager of the research and development department of Tuboscope Co., where he will supervise the development of new techniques and equipment for Tuboscope's nondestructive inspection services for tubular goods. Wood has been chief engineer for Tuboscope since 1955.

M. B. Schrier elected president

. . . of Walker Well Heads, Inc., replacing D. C. (Clint) Walker, who has retired due to ill health. Schrier formerly was the company's executive vice president.

M. B. Schrier

Earl Hoff, head of the engineering and developing department, has been elected vice president; Trey Ealey continues to hold the office of secretary-treasurer; and Gene Owen takes over as assistant secretary. Bob Cadenhead continues as general sales manager, and Walt Terhune stays on as plant superintendent.

Techniques of oilwell logging

. . . are presented in simple terms in a new full-color movie just produced for the oil industry by Welex, Inc., Fort Worth service company.

Titled "The Oilman's Prophet, a new look at logging," the 22 minute film will be used at well-log interpretation schools to be conducted in London and in Milan, Italy. The schools will be conducted by Dr. S. J. Pirson, Austin, Tex. and Jack Grynberg, author of "DST—Success or Failure?" page 106 of this issue.

Available for loan to oil companies, the film may be obtained thru Welex offices.

Republic Supply Co. purchases

... Perry Kilsby, Inc., Los Angeles tubing distributor, according to John J. Pike, Republic president.

Pike said the acquisition was part of Republic's expansion program and involved the purchase of all inventories and assets. He stated that all personnel will remain intact and that Perry Kilsby, the founder, will stay on as general manager. In addition, the firm will retain its name and continue to operate from its present Los Angeles headquarters.

Oilwell makes appointments

... and a transfer. Lewis Y. Poland has been named store manager, and Harold Leroy McDaris, field representative, at El Dorado, Kans., for U. S. Steel Corp.'s Oil Well Supply Division, reports Mark Barkhurst, Mid-Continent area manager.

Meanwhile, M. F. Jones, the division's Gulf Coast area manager, announced the appointment of Paul B. Norton as store manager at Laurel, Miss., and the transfer of Robert E. Beattie to Beaumont, Tex. as field representative.

Poland, who started with the company 12 years ago, most recently was field representative at El Dorado. McDaris, Poland's replacement, started with Oilwell in 1954.

Norton was named field representative at Brookhaven in 1958, the post he held until his present appointment. Beattie, an 11-year division veteran, held various management and sales positions in Texas and Louisiana prior to his new appointment.

Jim Rapier joins Cherokee

... Steel, Inc., as a sales engineer. Rapier, who has been in the gas-compressor and air-drilling industry in the Mid-Continent area for 20 years, was formerly with Gardner-Denver Co. of Tulsa. He will represent Cherokee in Oklahoma, Kansas, and the Texas Panhandle.

Meanwhile it was announced by David A. Garrick, president, that the company had acquired the former McNamar Boiler & Tank Co. Cherokee Steel is a division of Cherokee Laboratories, Inc.

Oil Base, Inc. appoints two

... to its sales and service engineering staff for Black Magic and special mud products. Both men—Jim Butler and Steve Curry—recently completed laboratory and field-training courses at Compton, Calif.

Butler will locate at the Oil Base plant in Duncan, Okla., under the supervision of Al Seaman, district manager. Curry, who formerly served with Magnet Cove Barium Corp. as a mud engineer, will be stationed at Houma, La., working under district manager Hal Farmer.

Air "repair station" receives

... a certificate of approval from the Federal Aviation Agency as an "FFA Certified Repair Station," according to W. E. (Pappy) Myers, manager of LeTourneau Air Center.

Myers said the new certificate of approval "answers a critical need by making possible recognized maintenance and inspection service to private aircraft owners throughout the southwest.

He added that the new service includes "major airframe and engine overhaul," and that the certificate was awarded after a year of extensive preparation and official inspections.

G. H. Tausch joins Camco, Inc.

... in the newly created position of director of engineering. He will locate in Houston.

Tausch was formerly with Humble Oil & Refining Co. in well-completion development work and reservoir engineering. He was in charge of field development and has authored technical papers on sand exclusion, permanent-type well completions, squeeze cementing, and similar operations.

Bill Graham rejoins Hillmac

... Division of American Coldset Corp. He will serve as area manager for the Oklahoma City, Kansas, and Oklahoma Panhandle areas.

B-I-F names W. L. Sammons

... to the newly created position of general sales manager, anounces Earl H. Bradley, president of the Providence, R. I. company.

In his new assignment, Sammons will head a team of field sales and service engineers located in major business centers throughout the United States and Canada, as well as four groups of process-systems engineers in Providence. In addition, Sammons will direct departments concerned with repair parts and export sales.

The new general sales manager was assistant to the president during the past 2 years. He was with Carrier Corp. before joining B-I-F Industries, Inc.

Louis T. Monson is named veep

... of Petrolite Corp. Monson is general manager of Tretolite Co., California division of Petrolite. Prior to his appointment to general manager of Tretolite in 1957, Monson had served as chief chemist and research director of the California division.

Diesel Equipment Co. to get

... a new $100,000 building in Wichita, Kans., where complete sales, parts, and servicing facilities will be established. The Wichita firm is a distributor of General Motors diesel engines in western Kansas.

The new building will provide 12,600 sq. ft. of floor space with servicing facilities that include an overhead crane system for handling within the shop and a special bay for accommodating engine servicing on large highway trucks.

Central Scientific Co. licensed

... by Sinclair Research Laboratories, Inc., to manufacture and sell a new petroleum instrument, reports John T. Gossett, president of Central Scientific.

The instrument, called the Sinclair-Cenco controlling and recording gravitometer, automatically measures and records gravity in crude oil. Gossett said that Central Scientific is now in full production on the gravitometer.

Central Scientific Co. is a wholly owned subsidiary of Cenco Instruments Corp.

F. W. Benzley is transferred

... from Medicine Lodge to Pratt, Kans. as location manager for Schlumberger Well Surveying Corp.

The firm also announced that G. G. Kemp is now serving as sales engineer at Shawnee, Okla.

John C. LaFave joins Republic

... Supply Co. at Oklahoma City as a special sales representative. For the past 4 years, LaFave has been with Childers Mfg. Co. as sales manager at Houston.

S. M. Jones Co. appoints

... Franklin Supply Co., Export Division, Inc., as export representative for Jones sucker rods and related products, according to M. B. Jones, president. S. M. Jones Co. is a division of Buffalo-Eclipse Corp.

Dowell sets up West Coast

... facilities to provide chemical cleaning services to industrial customers throughout the western area.

Sales operations are headed by Herbert H. Walther, general office sales engineer, who headquarters in Los Angeles.

Walther has been with Dowell Division of The Dow Chemical Co. in chemical cleaning services since 1944. He worked with industries on the East Coast until 1955 as both a treating and sales engineer. He has also served as a development engineer at Dowell's main offices in Tulsa.

Beckman names three new

... sales managers. Roy F. Brown takes over as sales manager for process instruments for the Scientific & Process Instruments Division of Beckman Instruments, Inc. George A. Green assumes that post in Beckman's eastern region, and Jack A. Challacombe, in the midwest.

Brown joined the firm 3 years ago as eastern regional manager, after having served as sales engineer for Minneapolis-Honeywell Regulator Co. and as an engineer for Westinghouse.

Green, who will be based in Mountainside, N. J., formerly served as a product-line manager and as western region sales manager for process instruments. Before joining Beckman, he was a senior development engineer for Great Lakes Carbon Corp.

Challacombe, who will operate from Chicago, formerly served as manager of the southeastern regional office located at the division headquarters in Fullerton, Calif. Prior to joining Beckman, he was with Cinecolor Corp. in Burbank, Calif.

M. T. Banks is added to staff

... of Instruments, Inc., where he will serve with regional sales in the Oklahoma and Kansas area. Banks formerly was employed in the electronics section of Douglas Aircraft Co.

Clark Bros. opens new facility

... for packaging the company's line of field compressors. Located at the Beaumont plant of Ideco, Inc., another Dresser division, the new Clark operation is designed to permit rapid delivery of packaged field compressors in the western and southwestern parts of the country.

Units will be mounted on skids, equipped with all necessary piping, and tested prior to delivery at the oil-field site. All main components, including balanced/opposed compressors, radiators, and scrubbers, will be supplied by Clark Bros, from Olean, N. Y.

Delta Tank Mfg. Co., Inc. names

... Arthur Joseph de la Houssaye superintendent of production of the Oil Field Equipment Division, reports Hal S. Phillips, president. The new superintendent will locate at Baton Rouge, La.

Williams Brothers Co. directors

... reelected for the coming year include: John H. Williams, Tulsa; Charles P. Williams, Tulsa; David R. Williams, Chagrin Falls, Ohio; Wilbur J. Holleman, Tulsa; and Robert E. Palmer, New York. The election took place at the company's annual stockholders meeting held recently.

Al Graff is named asst. manager

Al Graff

... of BJ Service, Inc.'s Rocky Mountain division, reports C. Z. Hughes, Rocky Mountain division manager. From his Casper, Wyo. office, Graff will determine market potential, correlate sales activities, and see to the continued schooling of BJ personnel in the division.

Tulsa firm to distribute

... Parker synthetic-rubber O-rings for sealing applications. Tommy J. McCuistion, vice president of sales of Parker Seal Co., named Industrial Gasket & Packing Co., Inc. as distributor.

Charles J. Donovan is president of the distributing firm. H. W. Moore is manager of the Tulsa operation. Technical assistance on sealing problems will be available from Milt E. Fassnacht, Parker's representative who headquarters in Wichita, Kans.

John Sly joins Dayton Rubber

... Co.'s Industrial Products Division as assistant sales manager, Robert Burson, vice president, reports. Joseph B. Maxson succeeds Sly as manager of the central region with headquarters in Dayton.

M. L. Buckler joins Badger

... Mfg. Co.'s staff as a process engineer. His duties include refinery and chemical-plant design.

Garrett Oil Tools, Inc. appoints

... Thomas J. Campbell Co. of San Francisco to handle the sales of Garrett relief valves, diaphragm control valves, and other industrial and pipeline equipment. Campbell will service the areas of northern California and western Nevada.

Joe Bull named sales manager

J. W. Bull

... of all Canadian operations for Milwhite Mud Sales Co., Ltd., announces George E. Conner, executive vice president of the Houston company. Bull, who will locate in Calgary, has been with Milwhite since 1953, having started with the company as an engineer in West Texas. Later he was city salesman in the Dallas-Fort Worth area and in Houston.

John J. Griffin is made

... chief engineer of Petro-Chem Development Co., Inc., it has been announced by John H. Wallis, president. Griffin, who joined Petro-Chem in 1954, was formerly manager of the service department. He had also served as chief engineer with National Airoil Burner Co.

George Yoakum is appointed

... district engineer of Sargent Engineering Corp. with headquarters at Midland, Tex., according to William H. Sargent, vice president and director of oil-tool sales. Previously, Yoakum specialized in production engineering with Fullerton Oil Co. at Hobbs, N. M., and Monterey Oil following its acquisition by Fullerton.

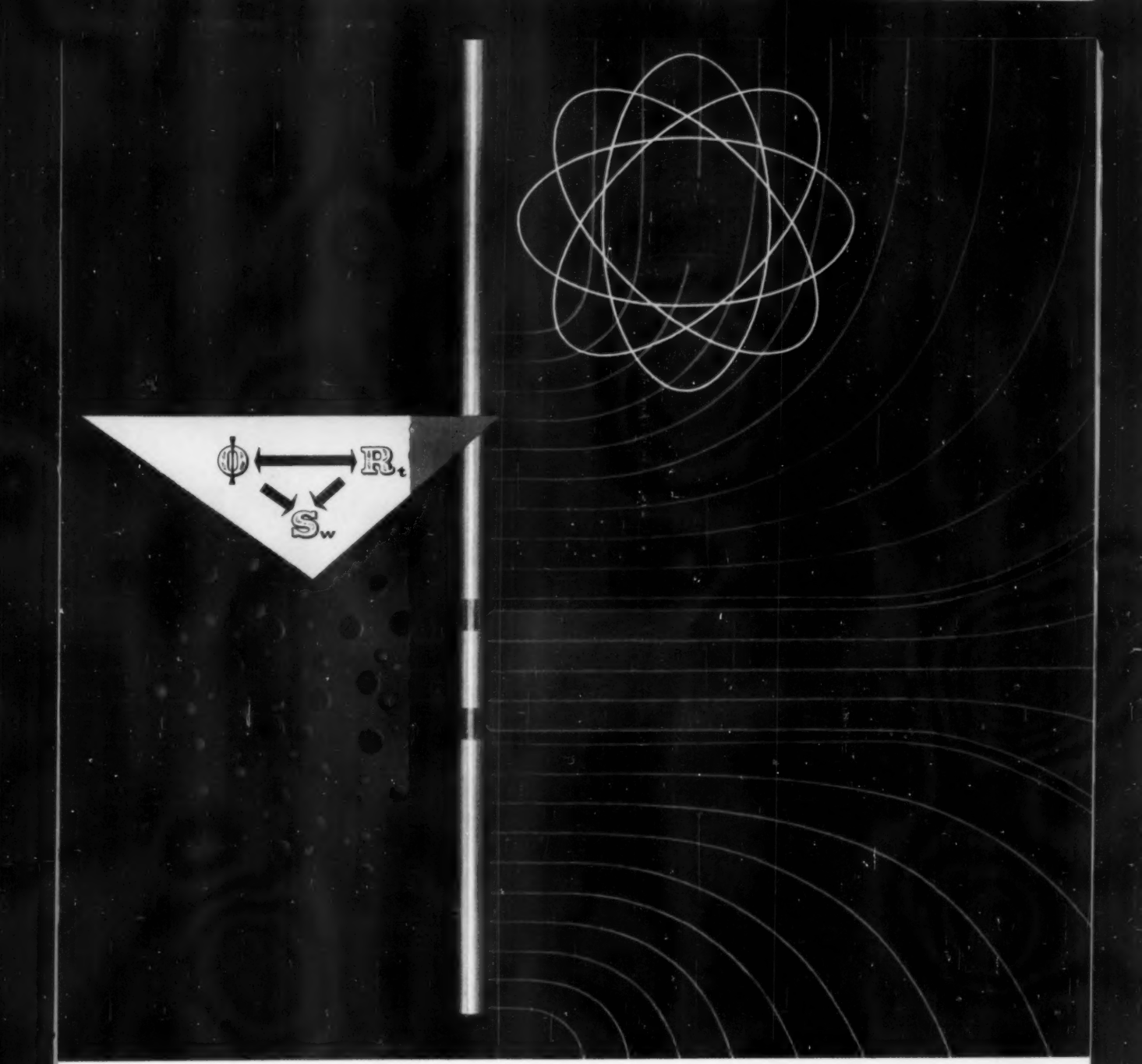
Supply office and warehouse

... at Arlington, Tex., is expected to be in operation by June 1, reports Howard C. Swain, manager of the Houston district for U. S. Steel Corp.'s warehousing and distribution unit.

At the same time, Swain announced that working space in the 45-ft.-high steel structure has been increased from the originally planned 39,000 to about 44,000 sq. ft. The new center will replace a smaller building U. S. Steel Supply has been using in Dallas since 1955.

John J. Freeman is appointed

... vice president and general manager of Magnetrol, Inc., Chicago. Freeman previously worked for International Register Co. of Chicago.



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simultaneous recording saves hours of rig time

Here is another logging *first* by Schlumberger, engineered to give you these extra benefits:

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- *Highly Sensitive Gamma Ray-Neutron*—the newest transistorized Schlumberger radioactivity logging instrument.
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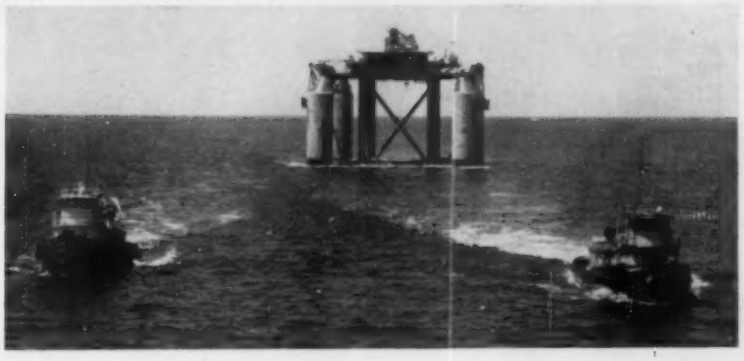


Built at Galveston,

Union drilling barge arrives at first Gulf location

UNION Producing Co.'s new 6,500-ton Drilling Barge "A," currently drilling a development well on Union's lease in Eugene Island Block 116, was towed from Galveston to first location by G & H Towing Co. tugs Juno and Grampus.

Drilling Barge "A," the most recent mobile unit commissioned into offshore drilling service, was built by Todd Shipyards Corp. The platform is designed and equipped to drill three wells from one location.

Rimrock Tidelands, Inc., of New Orleans, is the drilling contractor in charge of drilling operations.

California failures rise

According to API figures, California exploratory failures increased 16.4% the first quarter of 1959. This is significant despite a substantial decrease in the number of projects undertaken.

In the January-March period, 78 exploratory oil wells were drilled and abandoned as contrasted to 67 for this period last year. The chief cause in the failure increase was due to dry holes resulting from attempted field extensions. Wildcat failures in the first quarter totaled 24, identical to the number recorded in 1958. Outpost failures increased from 43 last year to 54 in the current year, which is a rise of 25.6%. API statistics reveal that the total of drilling wells abandoned was practically unchanged; a comparison note: 107 this year opposed to 109 in 1958.

The following table gives the comparative summaries for first-quarter results:

	1959	1958
Exploratory wells	78	67
Dry holes	24	24
Outpost failures	54	43
Total drilling wells abd.	107	109
New well completions	246	293
New oil wells	229	289
New gas wells	17	9
Abd. producing wells	71	53
Shut-in production (per day) (bbl.)	29,615	40,000

Shut-in output at the end of May had dropped to 13,500 bbl. a day. This compares with 45,000 bbl. daily at May's end last year.

State Division of Oil and Gas records show activity relating to old wells reworked totaled 243 for the first quarter of this year as contrasted with 283 for the same 1958 period. Since the first of April reworking of old wells has climbed sharply. For the first 5 months of the year, 455 drilling notices have been filed; last year there were 445 on record through the first 5 months.

DISSE meets at Midland

The stage was set at Hotel Scharbauer in Midland for the semiannual meeting of the Drilling Industry Society of Safety Engineers. Representatives from 16 key oil areas in the United States were present for the 3-day meeting, June 8-10. Topics discussed included: "Special Hazards Encountered in Various Geographical Areas," "Safety Indoctrination of New Employes," "Hazards of Air and Gas-Drilling Procedures for Checking and Testing Blowout Preventers," and "Hazards of Handling Materials on Drilling Rigs."

President of the society is Harry J. Ellis of Loffland Bros. Co., New Iberia, La. Ned Simes, Penrod Drilling Co., Dallas, is the program chairman, and J. Doyle Settle, Dallas, oilfield safety-equipment distributor, is secretary.

Sixteen companies were represented by the 23 registrants. The members' companies operate 330 strings of tools. During the meeting the discussions reviewed safety problems related to land and offshore drilling operations.

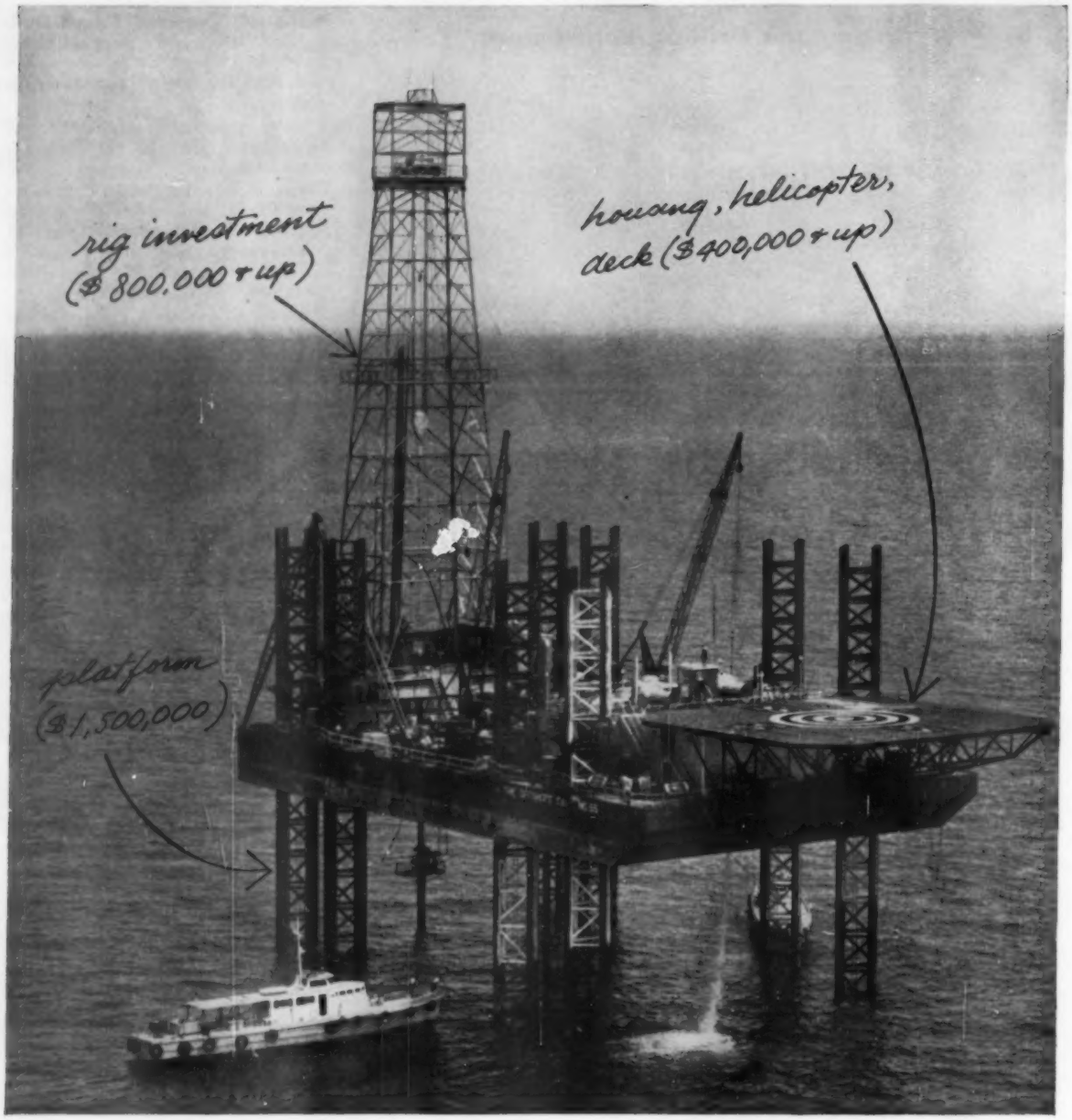
Those registering for the meeting included: Ray McNeil, Cactus Drilling Corp.; E. E. Scott, and G. W. Hutcheson, Great Western Drilling Co., both of Midland; Pat Wheeler, Fleeting Drilling Co., Ada, Okla.; Jack L. Taylor, Wheless Drilling Co., and C. R. Conrad, Fred Wilson Drilling Co., Shreveport, La.; W. W. Roberts, McAlester Fuel Co., Magnolia, Ark.; James Adair, Loffland Bros. Co., Odessa, Tex.; Morris Arnett and Harry J. Ellis, Loffland Bros. Co., New Iberia, La.; R. L. Higginbotham, Kerr-McGee Oil Industries, Inc., Morgan City, La.; J. Doyle Settle and Ned Simes, Dallas; W. W. Duncan, Loffland Bros., Tulsa.; John Jorgenson, Loffland, and Carl Heibucher, True Drilling Co., Casper, Wyo.; Max Loyd, Garvey Drilling Co., Wichita; K. K. Swanson, Moran Brothers, Inc., Farmington, N. M.; Archie Moore, The Offshore Co., Baton Rouge; John S. Jackson, Rowan Drilling Co., Fort Worth; Terry Young, Odeco, New Orleans; Kirby Roy, Zapata Offshore Co., and Robert L. Honey, Drilling Magazine, Dallas.

"Mighty Mole" trapped

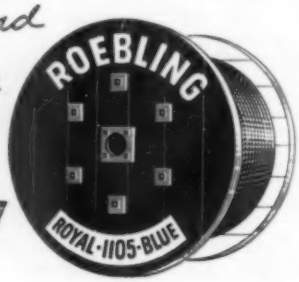
Brown Drilling Co.'s highly publicized "Mighty Mole" drilling rig was virtually destroyed recently when a blowout occurred in a gas wildcat it was drilling for G. E. Kadane & Son at Grizzly Island, Contra Costa County, California. Brown managed to salvage the rig pumps from the edge of the crater with the possibility that the draw works might also eventually be salvaged. The substructure, rotary table, and blowout preventers were lost in the 20-25-ft.-diameter crater. The blowout occurred at a depth of 1,000 ft. as pipe was being pulled preparatory to cementing surface casing.

AAODC moves

The American Association of Oilwell Drilling Contractors and The Drilling Contractor magazine have announced their new address, effective June 1. They are now located at Room 505, 211 North Ervay Building, Dallas. There was no change in phone number.



When you spend $4,000,000 for an offshore rig you can't afford not to use the best rope



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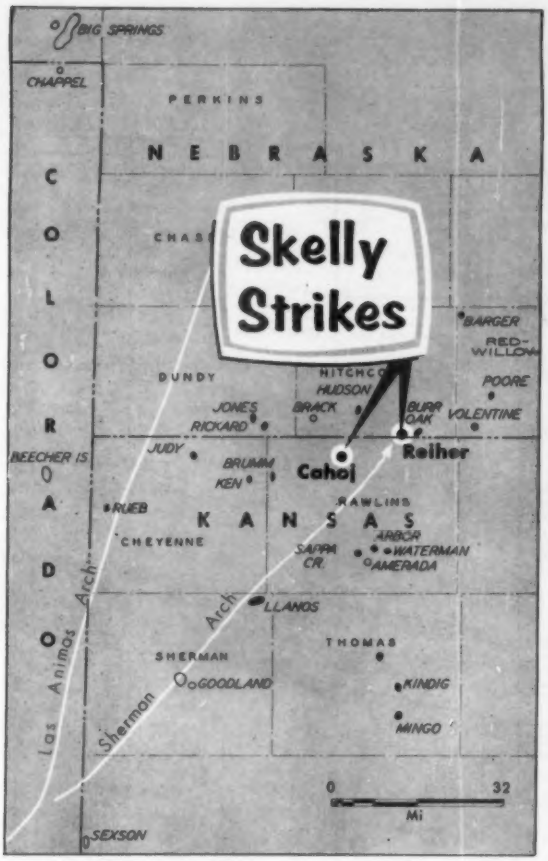


TWO EXCELLENT OIL STRIKES on the Kansas-Nebraska borderline have thrust this area into the headlines. Both are Skelly Oil Co. finds. These lie along the northern extension of the Sherman arch, as contoured on the Lansing-Kansas City pay horizon.

Skelly hits twice in plains country

BY FRANK J. GARDNER

TWO HEFTY DISCOVERIES, both by Skelly Oil Co., have stolen center stage in the plains country the past week. They're the biggest news since the discovery of Llanos field in Sherman County, Kansas, in June 1958. That was the strike that triggered a hot play throughout northwestern Kansas and southwestern Nebraska. The two new discoveries should underscore the importance of this province for future oil finding. One lies in Kansas, the other just across the line in Nebraska.

Good wells and fast offsets . . . Skelly has announced a final pump potential of 348 bbl. per day at the 1 Reiher, Section 28-1n-32w, Hitchcock County, Nebraska. Production is from three zones of the Lansing-Kansas City (Pennsylvanian) formation at 3,816-44, 3,862-70 and 3,910-20 ft. The discovery was carried to 4,390 ft. in Precambrian before plugging back to 4,011 for final completion.

Two offsets are already well on the way down. Skelly 1 Adams is nearing the completion stage as a north offset in Section 21-1n-32w; on latest tests of the "L.-K. C." pay, it swabbed 7 bbl. of oil per hour from perforations at 3,883-94 and 3,902-06 ft. To the east of the discovery, Skelly 4 Lewis Section 27-1n-32w, is drilling below 3,000 ft. on its way to the target sand.

At nearly the same time as the Reiher hit, Skelly met success 14 miles to the southwest in Rawlins County, Kansas. Here, the 1 Cahoj, in Section 17-1s-34w, was completed for 528 bbl. per day on pump. Again, the L.-K. C. had paid off, this time at 4,052-72 ft. Total depth was 4,732 ft in quartzite.

Skelly also has an offset rig whirling away here. The 1 Cahoj "A," in Section 8, north of the discovery is near total depth after recovering 3,640 ft. of free oil and 64 ft. of muddy oil on drill-stem test of the L.-K. C. pay at 4,163-4,230 ft. A west offset, the 1 Cahoj "B," in Section 18, is still in the location stage.

This pair of discoveries should provide the jolt to Kansas and Nebraska operators that was earlier prescribed in this column (OGJ, Sept. 8, 1958, p. 145) as an exploration stimulant for both states. The Reiher well is the biggest well ever completed in Nebraska outside the Denver basin. The Cahoj well is the biggest one for the northwestern corner of Kansas.

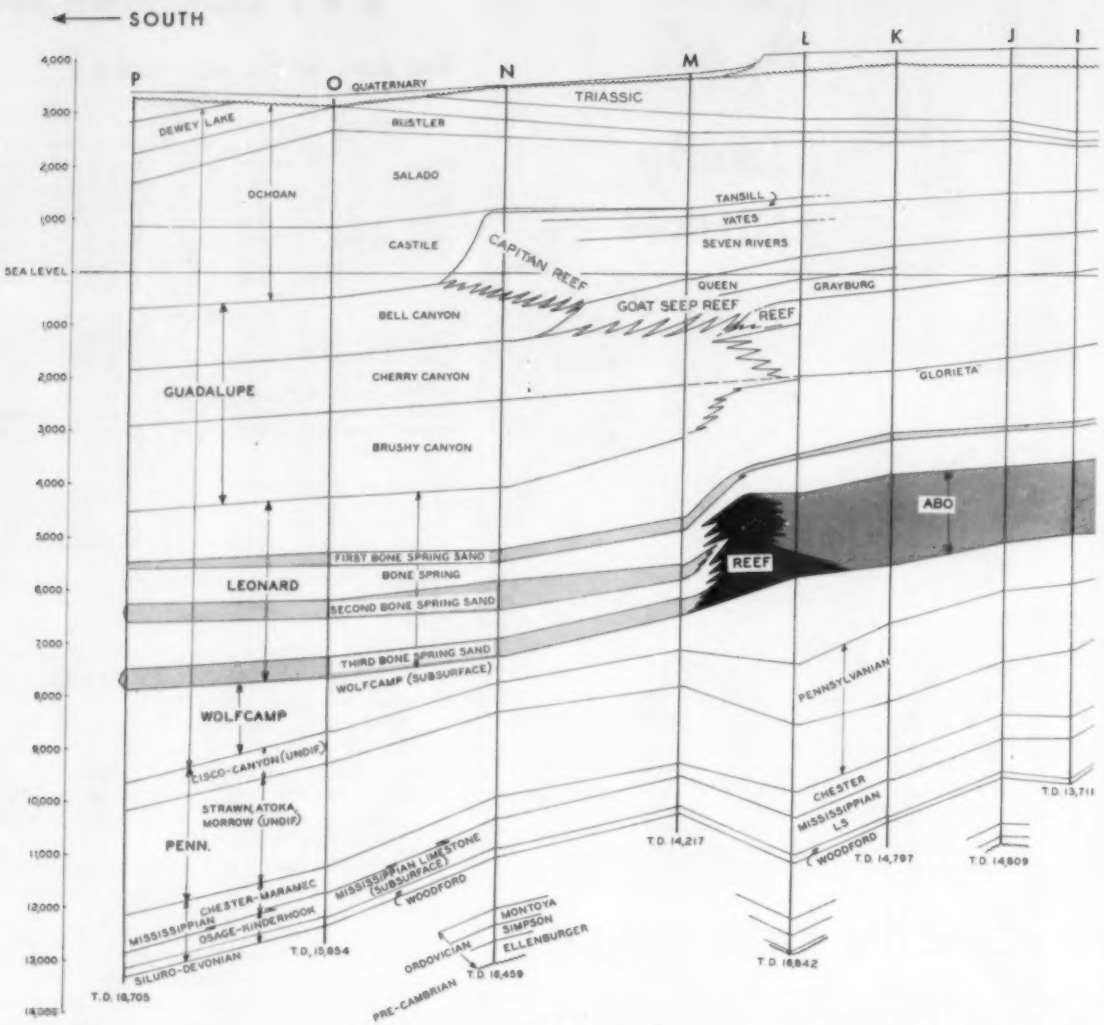
Should attract a hot play . . . The discovery at Llanos in 1958 sent scouts and landmen swarming over all four counties in the Kansas corner; that field has developed into a multipay Pennsylvanian field, with production in Cherokee, L.-K. C., and Marmaton. Other potential pays lie in the deeper Mississippian and Ordovician formations. This multiple-sand attraction, plus reasonable drilling depths and completion costs, should draw many a new wildcat into this two-pronged arch country in the next year or so.

The presence of the big Cambridge arch to the northeast provides yet another magnet for wildcatters in western Nebraska; so far, Barger and Poore fields of Redwillow County are the only discoveries flanking that arch, but eventually we can expect to see the play extended northward into Frontier, Lincoln, and Hayes counties. All in all, Nebraska stands to gain more from this "Kaneb" theater play than Kansas, if it can throw off its Denver basin obsession, that is.

Box score for the arch country

County and field	Date	I. P. (B/D)	Formation	Top pay (ft.)	T. D. ft.)
NEBRASKA					
Dundy, Jones	1957	20	L.-K. C.	4,184	4,600
Dundy, Rickard	1958	70	L.-K. C.	4,180	4,780
Hitchcock, Burr Oak	1958	143	L.-K. C.	3,862	4,371
Hitchcock, Hudson	1958	65	L.-K. C.	4,082	4,815
Hitchcock, Reiher	**1959**	**348**	**L.-K. C.**	**3,816**	**4,390**
Redwillow, Barger	1956	240	L.-K. C.	3,864	4,250
Redwillow, Poore	1956	60	L.-K. C.	3,644	4,102
KANSAS					
Cheyenne, Judy*	1951	5	Marmaton	4,496	5,141
Cheyenne, Ken	1959	83	Cherokee	4,768	5,390
Cheyenne, Rueb	1959	60	L.-K. C.	4,537	5,513
Rawlins, Arbor	1959	80	L.-K. C.	4,051	4,830
Rawlins, Brumm	1956	30	L.-K. C.	4,419	5,200
Rawlins, Cahoj	**1959**	**528**	**L.-K. C.**	**4,052**	**4,732**
Rawlins, Sappa Creek	1958	115	Marmaton	4,430	4,851
Rawlins, Waterman	1958	125	Marmaton	4,280	4,500
Sherman, Llanos	1958	319	Cherokee	4,804	5,001
Thomas, Kindig	1956	401	Cherokee	4,612	4,780
Thomas, Mingo	1953	25	Mississippian	4,684	5,100

Data shown apply to discovery well for each field.
*Abandoned.



NORTH-SOUTH cross-section made from electric logs in southeastern New Mexico. Producing wells are D, F, G,

New Empire Abo sparks rush to

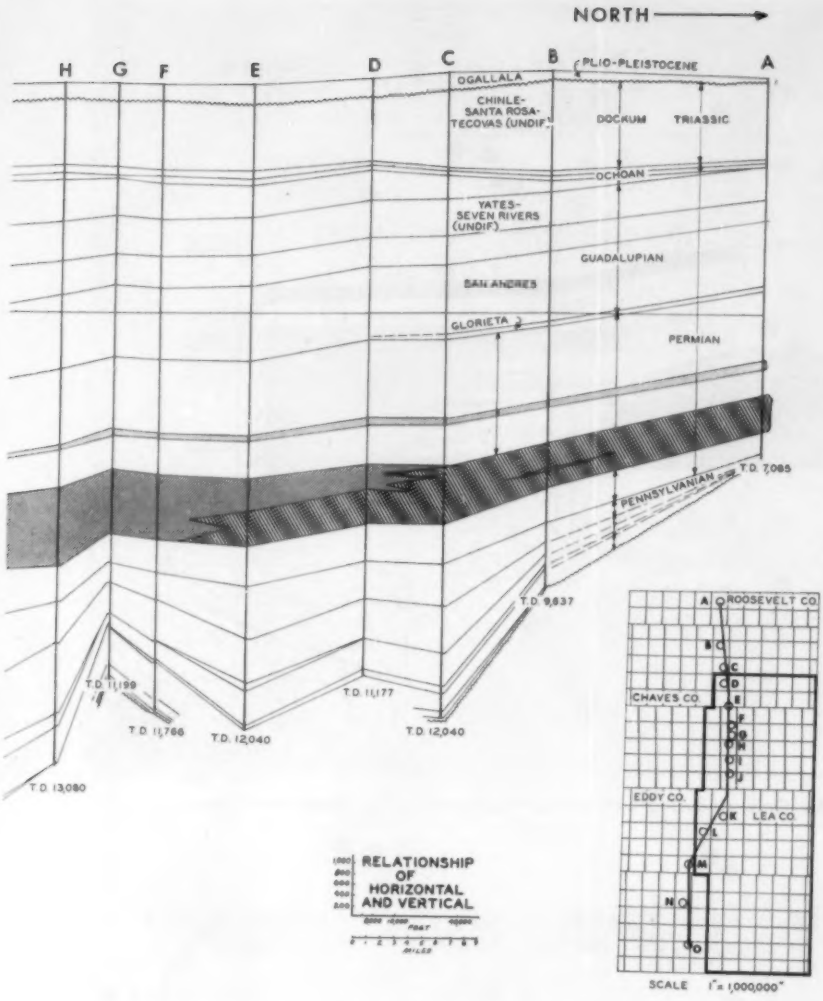
THE DISCOVERY of the Empire Abo field by Pan American Petroleum Corp. 10 miles east of Artesia, N. M., has caused a rash of new acreage purchases and drilling to the Abo horizon in southeastern New Mexico. The Abo pay is a barrier reef of lower Leonard (Permian) and extends across southeastern New Mexico in the subsurface from depths of 4,500 to 8,300 ft. (see regional facies map). It presently produces in two fields some 50 miles apart on the same trend and has indicated exceptionally large reserves at reasonable depths. The Empire Abo field in Eddy County (see map) has indicated the largest reserves from pays up to 600 ft. thick while the Lovington field in Lea County has large known Abo-reef reserves. The oil trapped in these two fields is the result of stratigraphic and structural relationships and stratigraphy plays the most important part. The following discussion will attempt to set out the statigraphic sequence surrounding the reef and show how the petroleum is trapped.

BY FRANK W. PODPECHAN
Helbing & Podpechan, Albuquerque

Geologic History

The lower Leonard lies immediately above the Wolfcamp formation and below the middle Bone Spring in the Delaware basin and the Yeso on the shelf areas. (See regional cross-section). During lower Leonard time the seas over the area seem to have been warm, clean, widespread, and shallow except in the Delaware basin where they were much deeper and pontic-type deposition was taking place.

The depositional history of the lower Leonard is very similar to other Permian sequences especially in the Capital reef of the Guadalupian period. There were three main en-



H, K, L, M, N, and O.

Southeast New Mexico

vironments of deposition during lower Leonard: (1) the basin, (2) the reef, and (3) the shelf. In these three environments there were three separate facies developed. They are: (1) the lower Bone Spring in the basin, which is made up of fine-grained gray sandstones, black shales, and dirty-gray to black limestones and dolomites, (2) the Abo reef on the basin edge or hinge line which is made up of white to tan coarse crystalline porous massive dolomites, and (3) the shelf or back-reef facies consisting of thin-bedded brown sucrosic anhydritic dolomites interbedded with green and red shales.

These environments or facies strike along the edge of the Delaware basin as it existed in lower Leonard time and the reef trends in the same direction. Along this depositional strike the basin facies changes rapidly to reef dolomites and then into shelf sediments and nowhere are the basin facies and shelf facies known to grade from one into the other. These two facies are quite diverse as to type, and since they are separated by a reef facies, the reef is defined as a barrier reef.

The regional facies map shows the facies change in plain view and the reef trend as it now appears in the subsurface. The trend line is general and there are undoubtedly undulations in the trend, especially where it crossed deeper structures. Where the reef crosses these deeper structures is probably the best place for reef production. The reef is approximately 1½ miles wide at its maximum, and it is easy to see that considerable prospecting must be done to find production in a narrow band such as this. It is a stratigraphic problem to be solved mainly by subsurface methods and the drill bit, although geophysics may prove effective if more advanced techniques evolve.

Producing Areas

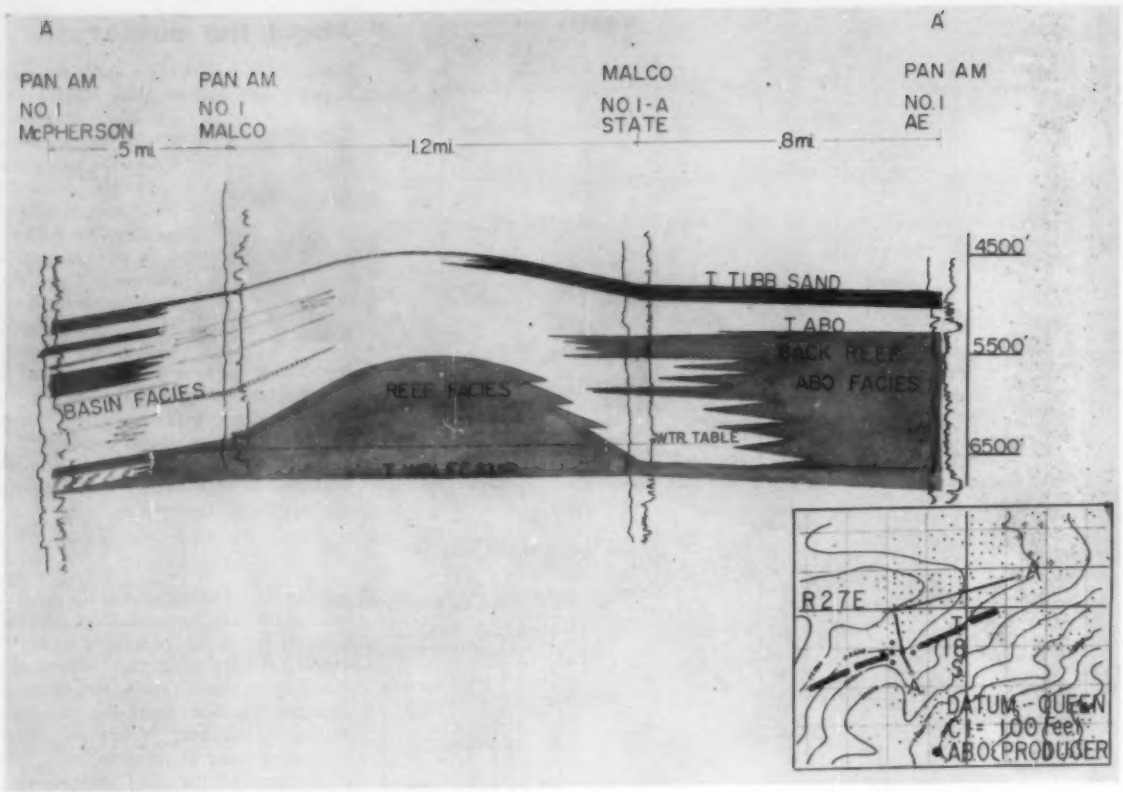
Since there are two fields presently producing from the reef, these fields have been analyzed. Cross sections have been drawn through the fields perpendicular to the reef trend and show the rapid development of the reef.

These sections show the very quick and definite facies change of the lower Leonard from basin to reef to shelf. Note the thick reef section of over 1,000 ft. in Lovington and about 850 ft. in Empire. These thicknesses indicate the reef grew nearly vertical while the basin was sinking slowly and relatively stable.

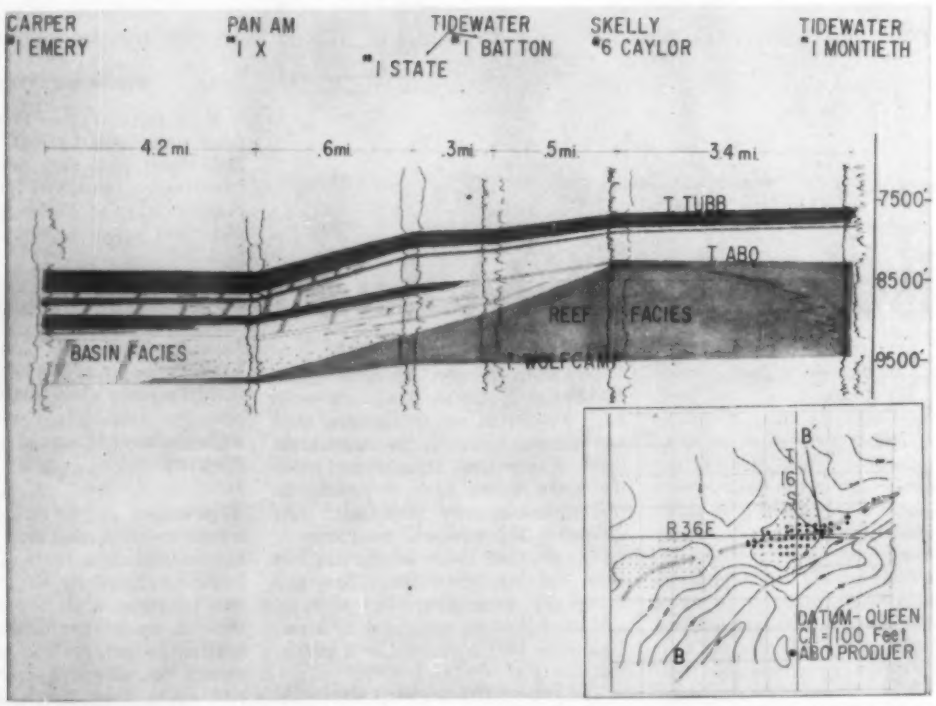
Type traps . . . The cross-section and subsurface structural map of the Lovington field show the reef production to be controlled by both stratigraphy and structure while the cross-section through the Empire field indicates no structural closure. The trap may be caused by porosity variation in the reef updip from production. Stratigraphy seems to be the primary control of reef production, although struc-

About the author . . .

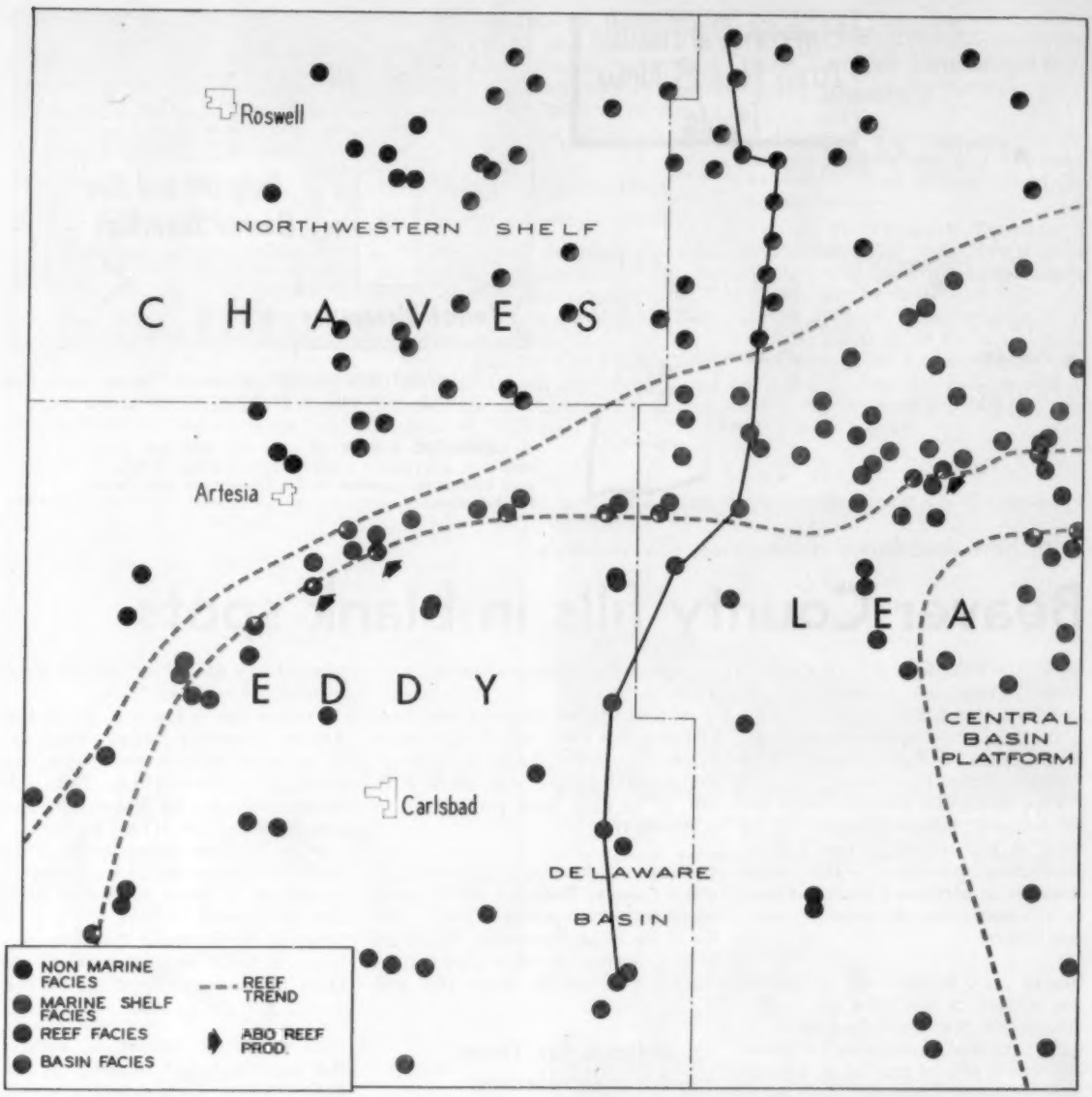
Frank W. Podpechan has spent the past 7 years engaged in New Mexico exploration problems. After graduation from Oklahoma State University in 1950 with a B.S. in geology, he worked with Pan American Petroleum Corp. for 5 years. In 1957 he joined the land and geological consulting firm of Helbing & Podpechan as a partner. Currently headquartering in Albuquerque, his company will move its offices to Roswell this summer. The author's prime interest is geological problems in southeastern New Mexico and the Four Corners area.



REEF FACIES is shown in this section, A-A'. Only producing well of the four shown is Pan American 1 Malco.



ANOTHER EXAMPLE of reef buildup is seen in this north-south section. Tidewater 1 Montieth test is to the north.



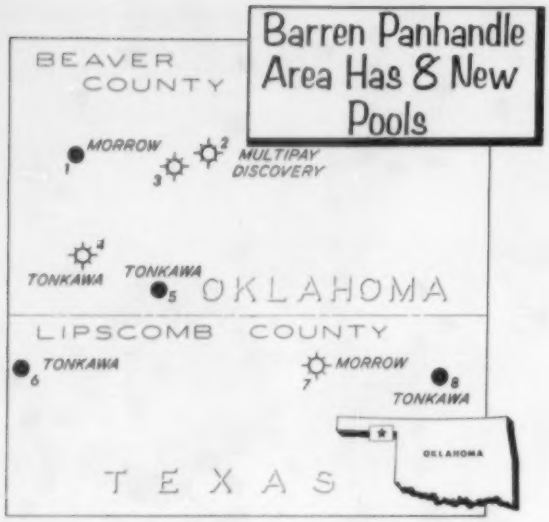
FACIES DISTRIBUTION MAP shows environments encountered by tests in Southeast New Mexico.

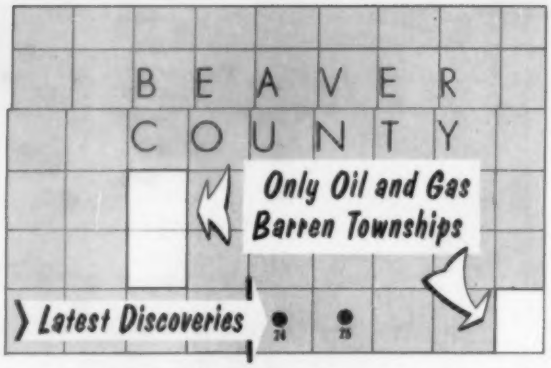
ture should be considered in exploration.

Reserves . . . Reserves in both fields are excellent and the depths to production are not excessive for stratigraphic exploration. Production ranges from 5,400 to 8,300 ft. in depth and west of present production the reef can be reached at less than 4,500 ft. In Lovington field, reserves are estimated to average 10,000 bbl. per acre while Empire Abo field has indicated much higher recoverable reserves of 25,000 bbl. per acre or more. Lovington field has already produced more than 8,000,000 bbl. of oil from 42 reef wells while Empire Abo field is too new to have cumulative production. It has indicated reserves of over 20,000,000 bbl. from the present 20 wells, and no dry holes have been drilled laterally east or west along the reef trend.

Return on investment . . . Drilling costs are a little above average for the producing depths but not excessive. The Empire wells cost from $85,000 to $100,000 to complete and the Lovington wells cost approximately $140,000. The return on investment is high, and some of the Empire wells will return the investment from 15 to 20 times. There seem to be no difficult drilling problems other than the hard carbonate section above the reef, although the wells nearer the basin side of the reef have a cherty section above the reef that causes slower drilling rates. Completions have been simple and natural after a small mud acid treatment. All of the wells have been completed flowing.

Exploration approach . . . In conclusion, the Abo reef is a reef facies of the lower Leonard and trends east-west along the edge of the Delaware basin as it existed then. The general trend can be located by regional stratigraphic studies through the use of well samples and electric logs while specific prospects are more difficult to locate and at this time the drill bit appears to be the only method. Depths to the reef range from 4,500 to 8,300 ft. and dry-hole costs from $55,000 to $90,000. Reserves are excellent and should give the necessary incentive to prospect with subsurface methods and the drill bit.





RECENT DISCOVERIES in Beaver County leave this area with only three dry townships.

A GENEROUS SUPPLY of new oil and gas pools opens a previously nonproductive strip of Beaver and Lipscomb counties in the Oklahoma and Texas Panhandles.

With new Anadarko discoveries, Oklahoma's

Beaver County fills in blank spots

NORTHWESTERN Anadarko's Pennsylvanian and Mississippian oil and gas coffers added eight new pools —all in a previously oil and gas-barren area of Beaver County and northern Lipscomb County.

Five of the new discovery areas are in southern Beaver County, all of them in two townships that had no production previously. The other three are in northern Lipscomb County in Texas where the same dry spell was broken.

Beaver . . . Morrow oil production was opened at Sun Oil Co.'s 1 Ellis Getz in SE NW 15-1n-24eCM (1 on map). The well, now testing on pump, swabbed 5 bbl. of new oil in 8 hours after mud-acid treatment. Perforations are at 8,044-50 ft. in the Morrow Pennsylvanian sand.

East of this area a multipay Pennsylvanian discovery area opened at Vickers Petroleum Co. 1 Mahaffey in SE NW 18-1n-25eCM (2 on map). The well flowed 5,700 M.c.f.d. on 18/64-in. choke from Tonkawa perforations at 5,945-60 ft.; from Morrow and Chester Mississippian it made 950 M.c.f.d. Perforations were at 8,355-96 and 8,420-80 ft., respectively.

The offset well to the west, 1 Anna Howard in NW SE 13-1n-24eCM (3 on map), flowed 4,150 M.c.f.d. plus 21.6 bbl. distillate on 24/64-in. choke to open upper Tonkawa production at 5,543-76 ft.

More Tonkawa success is reported at Statex Petroleum Co. 1 Nelson (4 on map) in C NW SE 27-1n-24eCM. This one made 2,500 M.c.f.d. on ¾-in. choke. Perforations were at 6,110-22 ft.

A Tonkawa oil discovery was completed at Sun Oil Co. 1 Caleb Harper in SE NW 36-1n-24eCM (5 on map). On pump gage the well made 87½ bbl. of oil daily from perforations at 5,990-98 ft.

In Texas . . . Moving south into Lipscomb County, Tonkawa and Morrow successes were reported at Wilcox Oil Co. 1 Bechtold, Section 27, Block 10, HT&B Survey, 3 miles northeast of Booker at 6 on the map. This well pumped 118 bbl. of oil per day from perforations at 6,142-70 ft.

Further east at James F. Smith and Armour Properties 1 Henry Frass, Jr. (7 on map), Morrow production was found at 8,684-8-714 ft. This well flowed 2,250 M.c.f.d. Location is Section 20, Block 10, HT&B Survey.

More Tonkawa oil production is reported at Texaco, Inc. 1 Anna Frass B in Section 17, Block 10 at 8 on map. This well flowed 191 bbl. of oil in 10 hours on ½-in. choke from perforations at 6,130-34 and 6,143-52 ft. Daily potential was fixed at 458 bbl.

Guidebook for Texas field trip is released

The Guidebook for Annual Field Trip of the Houston Geological Society and Gulf Coast Section of SEPM has been released. This field trip covered the Lower Tertiary and Upper Cretaceous of the Brazos River Valley in Texas. It was authored by Fred E. Smith.

The field trip continues the study of the Brazos River section, the upper portion of which was covered by the December 6, 1958, field trip of the Gulf Coast Section of SEPM and the Houston Geological Society. The chief aim of the trip was to give Gulf Coast geologists an opportunity to become acquainted with good exposures of Lower Tertiary and Upper Cretaceous formations, to understand their sedimentary history, and thus be able to better correlate despite facies changes. The guidebook gives many facts about the formations, reflects the latest and best thinking on the geology of the area, describes several good exposures, and shows how the localities may be reached.

The formations studied range in age from basal Middle Eocene to Upper Cretaceous, and vary in depositional environment from moderately deep open-sea marine to fluviatile.

Wyoming geologists schedule field trip

The Wyoming Geological Association will hold its 1959 Field Conference in the Big Horn basin. The trip begins at noon Wednesday, September 16, through Friday, September 18. This year's trip will be conducted on an informal basis, and will consist of 2 days of guided trips to introduce and orient participants in the basin.

This year's trip is headed by Ben

Leverett, Empire State Oil Co., as general chairman; and, Loy Harris, consultant, as cochairman. Lawrence Madison of Ohio Oil Co., Box 319, Cody, is chairman of the registration committee.

Wyoming exploratory well is completed

In Wyoming, Sunray Mid-Continent Oil Co. has completed 1 Wyoming Federal "A" as a gas well in Fremont County, as a ¾-mile extension to the West Lysite area field.

The exploratory well tested gas at the daily rate of 1 M.M.c.f.d. through a ½-in. choke following perforations from 4,170-80 ft. The pay is the basal Wind River formation. Tubing pressure was 145 lb., casing pressure 225 lb. Total depth of hole was 4,754 ft.

The well is in 32-39n-91w, Fremont County. Sunray holds in excess of 4,000 acres in the immediate area.

New gas pool indicated in Wayne County, Ohio

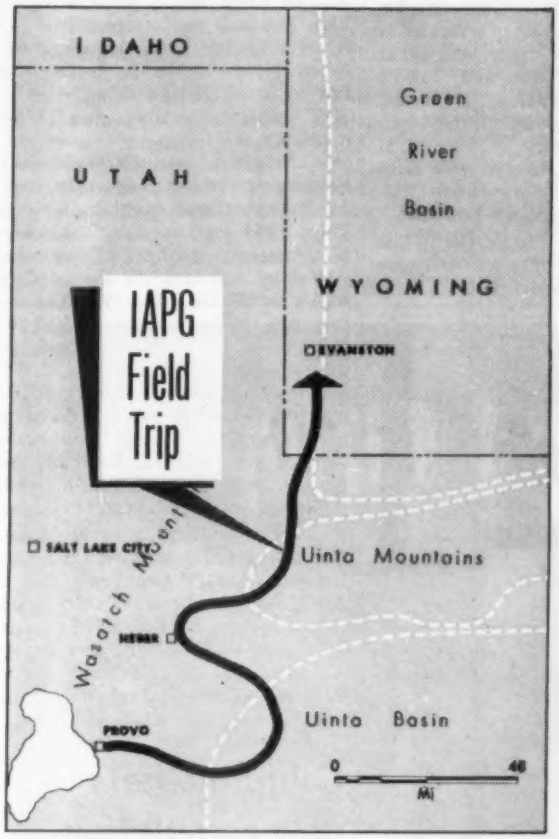
In Ohio a new gas pool, 1½ miles north of Smithville, is indicated by the results of Ohio Fuel Gas Co. 1 W. J. Ramseyer, Section 8, Green Township, Wayne County.

Natural gage from the Clinton sand at 3,424-47 ft. was 265 M.c.f.d. and 695 M.c.f.d. after fracture with rock pressure of 1,220 psi.

Lindenman field is new Central Kansas uplift discovery

An area of Graham County on the Central Kansas uplift that has failed to produce much oil has a good discovery indicated.

It is Peel-Hardman Producers 1 Lindenman, SEc 31-6s-25w, 8 miles northwest of Moreland in the northwestern part of the county. This discovery well of Lindenman field recovered 3,800 ft. of oil in two drill-stem tests of the Lansing-Kansas City at 3,672 ft. The operators set pipe at 3,842 ft. Swabbing got 14½ bbl. per hour for 5½ hours.



CLASSIC angular unconformity looking northeast at Echo Canyon; the Knight formation resting upon the truncated Echo Canyon conglomerates. This area is 19 miles southeast of Evanston, Wyo.

BALD MOUNTAIN, overlooking Mirror Lake. This popular Utah resort area is 50 miles east of Salt Lake City in the high Uintas. The field conference will stop here during its study of the Uinta Mountains.

IAPG members set for September Uinta tour

UTAH'S western high Uinta Mountains will be surveyed by the Intermountain Association of Petroleum Geologists this September 9 through 12. The association's 1959 field conference will begin at Provo, September 9. The next day the caravan will observe the geology northward along the Wasatch Mountains, including Diamond Fork, the Deer Creek thrust, Heber Valley into Smith-Morehouse Canyon, and the Strawberry Reservoir area. Other places to be studied include Mirror Lake, Echo Canyon, and Devils Slide. There will be emphasis placed on the connecting arm of the Uinta basin with Wyoming's Green River basin before the trip ends at Evanston.

Trip chairman is John Osmond, Salt Lake City. The guidebook editor is Dr. Norman C. Williams, professor of geology at the University of Utah.

Microfilmed records made available

Microfilmed records of approximately 45,000 wells drilled for oil or gas in parts of eastern Kentucky, eastern Ohio, western Pennsylvania, and West Virginia, have been placed on open file, it was announced today by the Department of the Interior.

The records were collected by the Geological Survey between 1943 and 1946 for studies of the lower Mississippian oil and gas sands in the Appalachian basin. Obtained from many sources—state and federal agencies, oil and gas companies, and numerous individuals—some records are detailed while others show only the oil or gas-productive sands penetrated in drilling. The collection is on 48 rolls of 35 mm. microfilm.

Well locations have been plotted on 15-minute topographic quadrangle maps each of which has been subdivided into nine 5-minute rectangles along latitude and longitude coordinates. They are numbered serially within each rectangle and the same numbering system is used for convenient reference on the well records.

Duplicate copies of the collection of microfilm may be obtained from the Library of Congress. Information concerning the duplication of the well records may be obtained from the Library of Congress, Photoduplication Service, Washington 25, D. C.

Kern drilling paces California

THE CENTER of attention in California, drillingwise, continues to be along the southern rim of the San Joaquin Valley in Kern County. Such names as San Emidio, Wheeler Ridge and North Tejon dominate the drilling news.

A late rundown on top developments in this scene of activity shows:

. . . **North Tejon.** A formation test on an extension test Reserve Oil and Gas Co. was drilling west of a fault block discovery midway between the Highway and Main areas indicated a potential 1,000 bbl. daily well in at least one interval. The well, 338-18 "W-T," flowed at a rate of 1,119 bbl. daily of 33.4°-gravity through an 18/64-in. choke from an interval at 10,859-10,923 ft. Reserve was drilling ahead after the formation test. The well is in SW SW 18-11n-19w.

. . . **San Emidio.** Production in the San Emidio Nose field was extended ½ mile east of production by a Richfield Oil Corp. well in NE NW 9-11n-21w. The well was completed in 221 ft. of zone selectivity perforated between 11,478-12,590 ft. It came in flowing at a rate of 611 bbl. daily of 30.2°-gravity crude through a 17/64-in. choke.

. . . **Sebastian area (North Tejon).** Promise was added to this area about 1½ miles northeast of the main North Tejon field production by the results of a formation test on a wildcat being drilled by Standard Oil Co. of California in SE SW 9-11n-19w. The test was run in the interval 7,850-7,965 ft. It was open 2 hours, 6 minutes during which 4,150 ft. of clean 37°-gravity crude was recovered. Standard was fishing a single stand of drill pipe at this writing. The well was total-depthed at 13,801 ft., but had been plugged back and redrilled to 8,061 ft. at the time of the formation test.

. . . **Wheeler Ridge.** Reserve Oil and Gas has staked a location for an extension of the JV sand production of the Windgap area of Wheeler Ridge field less than ¼ mile to the south. This well, 66-30 R-S-T-, will also be located about 1 mile southwest of Reserve's Olcese production generally associated with North Tejon field.

California gets new completion

ONE of the largest producers yet completed in the Beehive Bend gas field of northern California's Glenn County was brought in by General Petroleum Corp. on the north edge of the field.

The well, 1A Sprague-Lewis, was completed in the interval 3,084-3,408 ft. flowing initially at a 19,700 M.c.f.d. rate through a 74/64-in. choke. With a 1-in. choke, it made 15,200 M.c.f.d.

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20th Century Fox area gets new test

The 20th Century Fox movie lot in west Los Angeles on the Beverly Hills city limits is slated to see another operator enter that play. Allen Guiberson announced plans to drill a test on the Beverly Hills High School immediately adjoining to the east the film lot. The proposed Guiberson well will be drilled next to one of the last two wells still remaining in the old Beverly Hills field. However, like the wells on the film-studio property, it will not be associated with production of the original shallow zones of the Beverly Hills field. With Guiberson's entry into the play, the 20th Century Fox deep zones has been drilled on all sides, with the north side apparently unproductive.

One new pool for Illinois discovered

One new oil pool, Belle Prairie West in Hamilton County, was discovered in Illinois in May.

There were five extensions to pools, as follows: one each to Schnell South in Clay County, Ellery East in Edwards County, Iola Consolidated in Effingham County, Ina in Jefferson County, and Hornsby South in Macoupin County.

A total of 174 wells were completed in May, an average of about 35 a week for the 5-week period. The completions include 87 oil wells, or a success rate of 50%. In addition, seven old wells which had previously been completed as dry holes were worked over and recompleted as oil wells.

Estimated production for Illinois for May is 6,583,000 bbl. of oil.

Illinois basin production bolstered by finds

Illinois basin developments include discoveries in Richland, Clay, Christian, Gallatin counties, Illinois, and Henderson County, Western Kentucky.

Illinois . . . Aux Vases production is indicated ½ mile east of Wakefield in Richland County at Alva C. Davis 1 John Weber in NW NW SE 30-5n-9e. Recovery was 1,500 ft. of gas, 570 ft. clean oil on drill-stem test at 2,942-69 ft. Casing is set for a test at 2,940-50 ft. This wildcat is 2 miles from production.

In Clay County, Gulf Oil Corp. 1 Goudy, SW SW NW 5-2n-7e, 1 mile southeast of Flora, is one of the best wells in the area. It pumped 359 bbl. of oil per day from Aux Vases sand at 2,958-74 ft. This is a new area.

Schaefer Oil Co. is testing Silurian at 1,893-1,906 ft. at 1 Padgett in NE NW NE 7-14n-2w, Christian County wildcat. The well, 1 mile northeast of Edinburg, made 4 bbl. per hour on swab tests.

Kentucky . . . Cherry Hill, 4 miles west of Rock Springs, Henderson County, has a new pay. O'Neal & Co. 1 W. B. Allgood in 10-0-23 found 102 bbl. per day in the O'Hara lime at 2,498-2,504 ft., and 2,506-12 ft.

EVER WONDER ??

Geoquestion . . .

What about all these Uinta's in Utah, Wyoming, and Colorado?

Geoanswer

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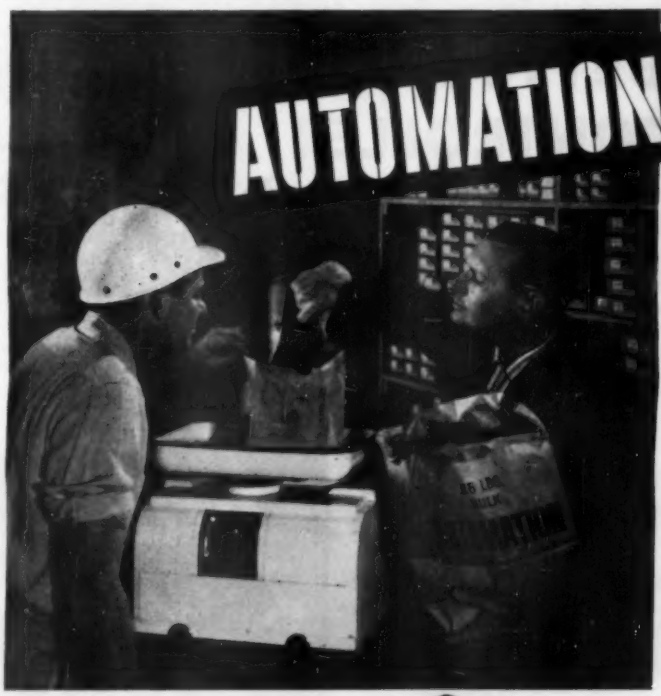

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Northeast Kansas slated for brisk wildcat play

Northeastern Kansas is set for a brisk wildcat play following a recent strike in Riley County and one in Morris County early in June. Both strikes are on the western flanks of the tristate Nemaha granite ridge which runs from the Oklahoma City uplift north-northeast into the Forest City basin's Nebraska portion.

The new Morris County discovery is E. H. Adair Oil Co.'s 1 Abeldt in NEc 9-12s-19w, 10 miles northeast of Herington, Kansas. Recovery on a drill-stem test in the Mississippian was 960 ft. of oil at 2,156-80 ft. Pay was found at 2,157 ft. This new pool is 9 miles north of Three Mile Creek field, another Mississippian producer. Recent strikes in this area have stirred an active leasing campaign in a portion of Kansas that had almost fallen asleep, drillingwise.

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Kansas' Praeger hits

Praeger field, 2½ miles southeast of Mackville, is a new Stafford County discovery area in Kansas.

Wilkinson Drilling Co. 1 Praeger, SW SW SE 36-24s-15w, was completed for 182 bbl. of oil daily in Arbuckle pay at 4,396-4,400 ft. The new pool is in the middle of an area surrounded by Saterlee, Farmington-Northeast, Moody, Farmington, and Grunder fields.

Glen field well confirms Kansas pool

A Central Kansas well flowed 300 bbl. of oil per hour before being shut in for lack of space. It is Fakari Petroleum Corp.'s Glen field offset discovery, the 1 Taylor in SE NE SW 14-23s-14w, Stafford County.

Lansing-Kansas City Pennsylvanian pay was perforated and acidized at 3,553-61 ft. The well kicked off, blew the tools out of the hole, and flowed 235 bbl. in 47 minutes. The well has been turned over to Leben Drilling Co. for completion and operation. This well confirms the Glen field discovery, 3 miles northwest of St. John, Kans. Natural Gas & Oil Corp. opened the pool.

Kentucky's Puncheon Camp adds producer

In East Kentucky's Puncheon Camp pool, western Breathitt County, Preston Oil Co. has added another Big Lime (Mississippian) producer. Located on Belcher Fork 3 S. Johnson initialed for 35 bbl. of oil daily at a total depth of 1,302 ft. Top of formation was recorded at 1,239 ft.

Attention shifts to northern Michigan

Northern Michigan claimed new interest and for the moment at least shadowed the southern Michigan Trenton play. Leonard Oil, Inc. 1 Laarman, NE NE SW 19-21n-7w, Missaukee County, on head flows averaged 51 bbl. oil day through 5-in. casing from Dundee dolomite at 3,971-74 ft.

Wildcat is located on the west end of the 1,700-ft. Michigan Stray sand gas-storage fie!d that covers 10 sec-

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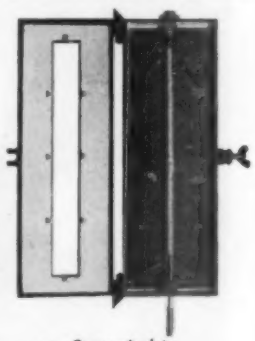

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tions, and 4 miles west of a lone wildcat well drilled in 1942 and still producing from the Dundee.

Leonard Oil, several independents, and Gulf Oil Corp. hold the bulk of the close acreage to the strike.

Offshore oil find completed off Louisiana

In the Gulf of Mexico Midwest Oil Corp. and Ocean Drilling & Exploration Co. completed an offshore oil discovery in Block 90, Eugene Island area, off the Louisiana coast. The 1,250-acre lease in 23 ft. of water is owned 54% by Midwest and 46% by Odeco.

The well was drilled by Odeco's offshore barge "St. Louis" to a total depth of 10,579 ft. In excess of 100 ft. of net oil sand was logged. The dually completed well tested as follows: Perforations from 10,323-34, 408 bbl. of 39.9°-gravity oil per day through 10/64-in. choke, 2,075 pounds flowing pressure, gas-oil ratio 799. Perforations from 10,178-92, 399 bbl. of 40.5°-gravity oil per day through 10/64-in. choke, 2,075 pounds flowing pressure, gas-oil ratio 662.

Company engineers consider the discovery to be of considerable significance, and an offset well is to be spudded immediately. Nearest production on the dome is approximately 1 mile to the south in Block 93, Eugene Island area, in which block Odeco also owns an interest.

Green County area has 1,100 producers

A revision of the oil and gas map of Taylor County which was issued earlier this year has just been announced by Dr. Wallace W. Hagan, state geologist. Through the field investigations of Thomas J. Crawford, survey geologist, more than 220 additional well locations have been added to the new map, making a total of 358 wells which are pinpointed and identified.

Taylor County is immediately adjacent to Green County, where the nation's most intensive shallow oil play continues. Dr. Hagan pointed out that more than 1,100 wells in Green County are currently yielding between 40,000 and 50,000 bbl. of oil per day. One of the highly productive spots is along Big Pitman Creek near the Green-Taylor County line.

The map is issued in two colors and is drawn at a scale of 1:48,000. Price, including packaging and postage, is $2.20. It may be obtained from the Survey office on the University of Kentucky campus in Lexington.

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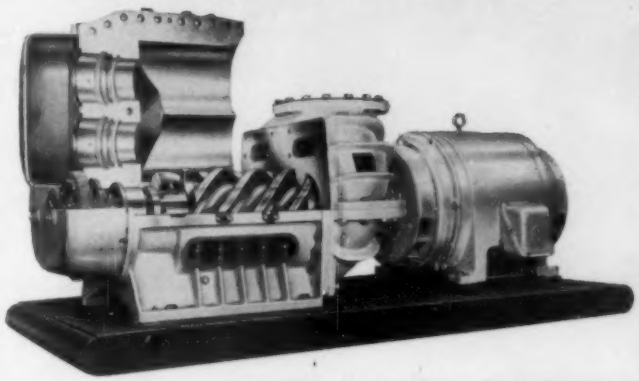

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Despite hard-to-reach drill sites

Wildcatters keep busy in B. C.

STIRRED by western Canada's biggest gas discovery of the year at Kotcho Lake in northeastern British Columbia, wildcatters will be busy this summer in the Fort Nelson and Jedney-Bubbles area.

Six rigs will be probing this vast new gas province. The excitement began this past winter when Gulf States Oil Co. of Canada, Ltd., an affiliate of El Paso Natural Gas Co., found prolific gas production in Devonian Slave Point rocks, the equivalent of famed Swan Hills pay. The other Middle Devonian area is Petitot River near the Northwest Territories boundary.

Southwest of these strikes Pacific just opened two gas fields in the Jedney-Bubbles area. Four Triassic gas wells have been drilling along a 12-mile line about 20 miles northwest of Nig Creek field. Other Triassic strikes have been reported in the area —10 miles northeast, 5 miles to the southwest. These six wells could well point up a tremendous new multipay Triassic gas field more than 20 miles long.

Bubbles, 8 miles southeast of the Jedney discovery, flowed up to 11,700 M.c.f.d. on production tests from Upper Triassic dolomite. The Jedney well has had competion difficulties and will not be finished until roads improve in the region.

The six rigs reportedly working the area this summer may develop as many as 32 more locations. The new gas fields all lie in the area made available for service for the Big Inch pipeline of Westcoast Transmission Co. Indicated reserves in this area are of such extent that engineering is already under way for increasing the gathering system's capacity.

Lake Erie drilling sets fast pace on Ontario side

Summer drilling on the Ontario side of Lake Erie is brisk. The second success of a 4-well series being drilled by Place Gas & Oil Co., Ltd., offshore in the lake is reported.

The Place 5 Dover, 2 miles south of Port Dover, blew in with a natural open flow of 450 M.c.f.d. from a good pay section in Red Medina sand.

A stepout well, 3 Walpole, flowed natural up to 1 M.c.f.d. This well was drilled on the new floating-type drilling platform, Mr. Cliff. The platform was moved to 7 Walpole, ½ mile south of the 3 Walpole and about 1¾ miles offshore.

At the western end of Lake Erie, the 1 Gosfield, 1 mile offshore from Kingsville, flowed gas and is now being fractured for increased production. Offsets have been spotted to this well.

Farther west, on a 9,400-acre block offsetting Imperial-Harvest-Submarine South Colchester well, the Place 1 Colchester is drilling to the Trenton at about 2,100-2,200 ft.

Place has ordered two more drilling platforms similar to Mr. Cliff for further drilling this summer and fall.

Canada report available

A new comprehensive report covering oil and gas news in eastern Canada is available.

Eastern Gas and Oil Report, published by H. L. Akins Publishing Co., Ltd., Box 37, Port Credit, Ont., is a valuable addition to Canadian oil and gas news. With the intense interest being stirred in the Great Lakes and Maritimes areas in recent months plus the promise of one of the biggest drilling years yet in the eastern provinces, this report will become even more helpful to those seeking to have complete coverage of this region.

Texas Panhandle wildcatting sparks new 1959 action

WILDCATTING in the southern Texas Panhandle hit a new stride for the first half of 1959. The score so far this year: 17 completed wells scattered over 8 counties, 3 currently drilling, and 3 new locations.

Nearly all of these wells have been, or are, in the "remote wildcat" classification, with no nearby production. Contract depths usually have been calculated to reach Precambrian granite.

Wildcats drilled by counties, all dry, are: Oldham County, six wells totaling 39,401 ft.; Randall, three wells and 25,578 ft. Counties having one completion, and its depth, are: Donley, 4,503 ft.; Hall, 6,210 ft.; Deaf Smith, 8,826 ft.; Carson, 7,503 ft.; Hartley, 5,450 ft.; and Moore, 7,790 ft.

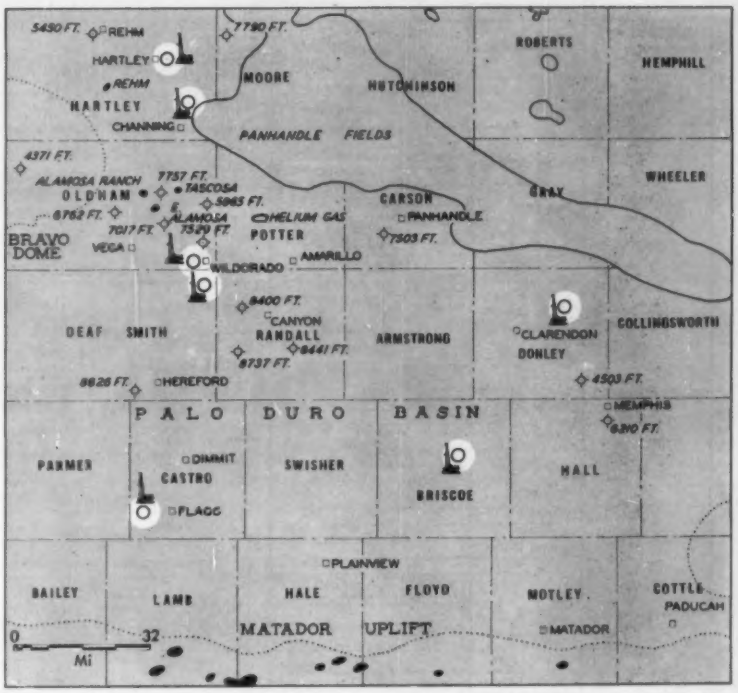
This tally of exploration wells and footage does not include the Carson County wildcats drilled along the flank of the Amarillo uplift, within the area designated as the Panhandle field in Texas.

The last frontier? . . . Palo Duro basin (which in Texas includes all of the above counties except Hartley and Moore), has been referred to as one of Texas' remaining unexplored basins. Three years ago Shell Oil Co. tapped the big basin's first oil at Alamosa Ranch. Immediately following that discovery, it enjoyed a busy but brief exploratory period.

Last year interest moved into the eastern end of the basin, at Jackson County in southwestern Oklahoma, where Southwest Duke field was opened. This field was the first production in the southeastern end of the basin. "Edge-basin" oil in Tillman County is considered important to the basin's present, as well as its future.

Earlier this year, two wildcats were drilled in the Tucumcari embayment. These wells were at the extreme western end of the long east-west Palo Duro basin, in New Mexico's Quay and San Miguel counties. Both were drilled into granite, both were dry.

For several years, exploratory drilling moved up and down the Matador arch, which is the southern limit to Palo Duro, but with little success. Now this drilling has moved out into the basin center, and even northward into Dalhart basin, which extends down into the northwest corner of the Panhandle.



INTEREST in Texas portion of the Palo Duro basin is indicated by the number of remote wildcats on the map. Two of the drilling wells shown here have reached contract depth at this time, and one additional location has been announced. These wells are in northeastern Hartley and northeastern Deaf Smith counties. Potter County received the new test.

By **CARL HOOT**
District Editor

In the Dalhart basin . . . Until late last week Slagter Production Co. 1 W. H. Baker had hopes of opening the second oil-producing area in this basin. Operators topped the Des Moines lime at 6,545 ft., then recovered 105 ft. heavily oil and gas-cut mud on a drill-stem test at 6,555-93 ft. A re-test of the same interval had approximately the same recovery. The well was drilled ahead, topping the Ellenburger at 7,220 ft. Final drill-stem test was made at 7,200-7,476 ft., total depth, but the return was 380 ft. of drilling mud with no shows and the well was ordered abandoned. Location is Section 24, Block 2, BS&F Survey.

No. 1 Baker is 14 miles northeast of granite wash (Pennsylvanian) production in the seven-well Rehm field, the only oil production in Dalhart basin. Channing field, north of the town of the same name, has been depleted.

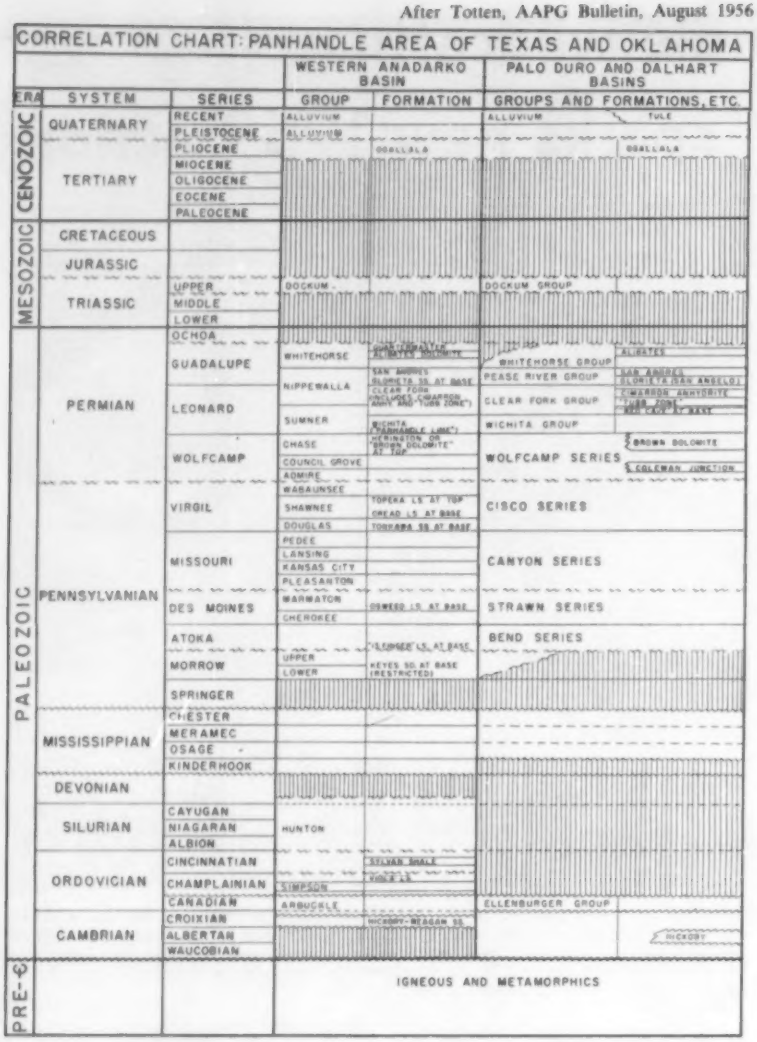
Shell Oil Co. 1 Thompson, also in southeastern Hartley County, had total depth at 5,427 ft., with no shows reported.

In the Palo Duro basin . . . Locations and drilling wells probing the center of the basin are:

. . . In Donley County, Texas Gulf Production Co. 1 W. J. Lewis. Location is in Section 92, Block E, D&P Survey, 15 miles northeast of Clarendon. Nearest production of any kind is gas production in East Panhandle field, about 8 miles to the north. Drill site is 3 miles north of a 5,054-ft. dry hole drilled by Magnolia, and 2 miles south of a 4,092-ft. duster drilled by Pan American Petroleum (then Stanolind). No. 1 Lewis was drilling below 4,895 ft. late last week.

No. 1 Lewis is on a block of 2,560 acres which apparently has been farmed out from Magnolia Petroleum Co.

After Totten, AAPG Bulletin, August 1956



. . . In Briscoe County, Tule Drilling Co., Snyder, Tex., has staked location for an 8,000-ft. test in the central portion of the county, 10 miles northeast of Silverton. New wildcat is 1 Ritchie Cogdell & Son. Location is on a 4,000-acre block, in Section 19, Block E2, D&SE Survey. It is just east of a 2,531-ft. dry hole, in an area which has seen very little deep exploration. Briscoe County has no production.

. . . In Deaf Smith County, Frankfort Oil Co. has issued plugging orders for 1 Muse, Section 14, Block 7, BS&F Survey. Total depth is 7,988 ft., in granite topped at 7,964 ft. The well had some shows of gas at 6,960, 6,957 and 7,008 ft. Location is 8 miles south of Wildorado, in Section 14, Block 7, BS&F Survey.

. . . In Castro County, Amarillo Oil Co. is drilling below 3,045 ft at 1 Boothe, 5 miles west of Flagg townsite. The proposed 9,600-ft. wildcat is in Section 16, Block 0-4, D&SE Survey. It is 5½ miles northwest of a 3,970-ft. dry hole drilled by Sun Oil. There is no production in Castro County, nor in this portion of the basin.

. . . In Oldham County, Humble Oil & Refining Co. was drilling below 6,500 ft. at 1 Jessie F. Binford "B," Section 18, Block Z-3, S. Bradley Survey. A 30-minute test at 6,381-6,410 ft. recovered 20 ft. of slightly gas-cut mud. Location is 14 miles southeast of the one-well East Alamosa field.

. . . In Potter County, gained a new wildcat by Humble Oil & Refining Co., 2 miles northwest of Boden townsite. The project is 1 Caroline Bush Emeny, in SE SE Section 9, Block M-19, G&M Survey. Location of the well is not shown on the accompanying map. Projected depth is 7,500 ft.

Pleasant Prairie area combined by commission

Extensive drilling has led to the development of a single large oil field out of three original producing areas in southwestern Kansas, according to a recent decision of the nomenclature committee of the Kansas Corporation Commission.

In reviewing Docket No. 57-743-C the commission called for the name of Pleasant Prairie field to cover the areas known previously as Pleasant Prairie, Northwest Pleasant Prairie and Southside pool, located in Kearny, Finney, and Haskell counties, Kansas.

The newly designated oil field has been proven over 7 miles in length and varies up to 3 miles in width. The most active operator in the field, White Eagle Oil Co., Tulsa, now has 45 wells completed within its 25,000-acre block and has drilled only two dry holes.

Production is from the Mississippian formation (about 5,100 ft.) lying beneath the Hugoton gas pay which blankets the area. In addition to the Mississippian oil zone, some wells have been dually completed by White Eagle in the Morrow sand and in other wells, the Kansas City-Lansing is productive.

Discovery wells

CALIFORNIA

Contra Costa County: Trico Oil & Gas Co., 1 Faria Unit, NE NW 21-2n-1w, 4,300 M.c.f.d., ¾-in. choke, perfs. 1,714-77 ft. TD 4,522 ft. (New gas field discovery 2 miles southeast of Los Medanos gas field in the Port Chicago area).

WESTERN CANADA

Alberta: B-H PRP-Richfield 11-34-13-7 Medicine Hat, LSD 11, 34-13-7w4. Medicine Hat gas discovery. TD 3,110 ft.

British American-CPR 5-7-36-20 West Fenn, LSD 5, 7-36-20w4. Viking and Detrital gas discovery. TD 6,960 ft.

British Columbia: Pacific-Imperial B-33-I Bubbles, 33-I-94-G-I. Triassic gas discovery. TD 4,970 ft.

Saskatchewan: Sarcee-Canpet et al. 10-2 Braeborn, LSD 10, 2-31-20w3. Viking oil discovery. TD 2,300 ft.

COLORADO

Baca County: Frontier Refining Co. 1 State-Holt, NW NW 15-35s-41w. IPF 1,500 M.c.f.d., Topeka discovery, new field. TD 4,764 ft.

LaPlata County: Southern Union Gas Co. 6 Ute, NW SE SW 16-32n-11w. IPF 1,466 M.c.f.d.; IPF 431 M.c.f.d., Mesaverde and Dakota. TD 7,562 ft. Morrison. Dakota discovery, new field.

ILLINOIS

Clay County: Shulman Bros. 1 Barnett, SE SE NE 6-2n-7e. IPP 144 BOPD, 20 BWPD, Aux Vases 2,972-86 ft. TD 3,110 ft. Oil discovery in Illinois basin.

MONTANA

Rosebud County: Honolulu Oil Corp. 11-11 Fee, NE SW 11-11n-31e. IPF 568 BOPD, Tyler "C" sand discovery, new pay. 5,486 ft. Heath.

NEBRASKA

Banner County: Pan American Petroleum Corp. and Brinkerhoff Drilling Co. 1 Van Pelt "K," NE SW 10-17n-56w. IPP 500 BOPD, "J" sand discovery, new field. TD 6,706 ft. "J" sand.

Hitchcock County: Skelly Oil Co. 1 Reiher, C NE NE 28-1n-32w. IPP 348 BOPD, Lansing-Kansas City discovery, new field. TD 4,390 ft. Cherokee.

Kimball County: Arapahoe Drilling Co. 1 Person, C NE SW 5-12n-58w. IPP 203 BOPD, "J" sand discovery, new feld. TD 7,345 ft. "J" sand.

NEW MEXICO

Lea County: C. W. Trainer 1 Jordan, 11-20s-35e, 12 miles southeast of Monument. IP 5,200 M.c.f. of gas, open-flow, Seven Rivers 4,104-27 ft. Recompletion. Old TD 4,360 ft., PB 4,204 ft.

NORTHWEST NEW MEXICO

Rio Arriba County: W. R. Johnston-Warren Shear 3-9 Jicarilla, SW NE NE 9-24n-4w. IPP 181. BOPD, Dakota discovery, new field. TD 7,452 ft.

NORTH DAKOTA

Burke County: Ivan Goheen 1 R. M. McCarthy, C SE SW 5-162n-90w. IPF 102 BOPD, Nesson discovery, new field. TD 5,877 State A.

OHIO

Wayne County: Ohio Fuel Gas Co. 1 W. J. Ramseyer, Section 7, Green Township. Clinton 3,424-47 ft. IPF 644 M.c.f.d., 1,220 psi. TD 3,530 ft. New gas pool.

OKLAHOMA

Beaver County: El Paso Natural Gas Co. 1 Schneider-Oklahoma, NW SW NE 36-1n-26eCM. IPF 140 BDP 17 hours, 54°, 8,250 M.c.f.d., 24/64-in. choke, Morrow 8,524-60 ft. TD 8,952 ft. Gas-condensate discovery in Oklahoma Panhandle.

Republic Natural Gas Co. 1 Nine, C SW NE 21-3n-27eCM. IPF 4 BDPH, 21,800 M.c.f.d., Hoover 4,592-4,612 ft.; IPF 8 BDPH, 3,850 M.c.f.d., Tonkawa 5-619-28 ft. TD 7,783 ft. Gas-condensate discovery in Oklahoma Panhandle.

Republic 3 Nelson, C SW NE 28-3n-27eCM. IPF 3½ BD 8 hours, 1,900 M.c.f.d., Morrow 7,410-28 ft. TD 7,768 ft. Gas-condensate discovery in Oklahoma Panhandle.

NORTH TEXAS

Archer County: Taubert & Steed 1 Edwards, Blk. 43, Madison CSL, Lule P. Hunt Subd., A-268, 4 miles northwest of Scotland. IPP 50 BOPD, 43°, GOR 400:1, Caddo 5,268-78 ft. TD 5,860 ft. Elevation 1,010 ft.

Gulf Oil Corp. 1 J. R. Parkey, Jr. "A," Dallas CSL Sur., A-113, 9 miles northeast of Megargel. IP 420 BOPD, 11/64-in. choke, TP 800 psi., 37.9°, GOR 419:1, Mississippian 5,181-5,217 ft. TD 5,226, elevation 1,106 ft.

Jack County: Trice Production Co. 1 Vera Roney, Sec. 3321, TE&L Sur., 3½ miles northeast of Jermyn. IP 255 BOPD 27/64-in. choke, 42°, GOR 500:1, TP 125 psi., Caddo 4,593-4,610 ft. TD 4,980 ft., elevation 1,159 ft.

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THE MAN who oversees Humble Oil & Refining Co.'s employe-relations program is a former roughneck and driller who once sat on labor's side of the table in the first labor-management talks ever conducted by Humble's production department.

As an example of a man who could move through the ranks to the post of vice president and director of the giant Humble organization, Ray H. Horton can speak with first-hand authority of reasons why his company has an esprit de corps unsurpassed among the majors in the oil business.

"Humble has always felt its greatest asset is its employes," Horton says. "We have always had good, liberal benefit programs; we pay well. We spend more time in employe meetings and discussions than any other company I know about.

"The board of directors will stop to consider an employe-relations problem quicker than any other. From the president on down, they want to know all about it. I think that the loyalty and attitude of our employes is one of the main reasons for the success of this company."

Depression start . . . If Horton is a frustrated geologist, he won't admit it. Nor does he act it.

But the facts are that he took a degree in geology from the University of Oklahoma in 1930—when geologists were "a dime a dozen." Though he could have had a job with another company as a land scout—"with a car, too"—he took the advice of a veteran drilling contractor and went to work for Humble as a roughneck on core rig south of San Antonio.

"You'll have a better future," said Gene Morter, whose Morter Drilling Co. of Ardmore, Okla., had employed Horton for summer and vacation work for the previous 5 years.

Morter, who died earlier this year in Dallas, gave Horton good advice.

Horton was born in 1907 at Denison, Tex. His father died 3 years later, and Mrs. Horton took Ray and his brother, Hal, to Ardmore to live.

Ray became a star halfback on the high school football team (all-conference), was second all-state in basketball, and lettered in track. He was also an honor student.

At the University of Oklahoma, he obtained his geology degree at a time when the oil industry was reeling from the blows of the depression.

The way up . . . For 4 years Horton worked for Humble in the fields of Southwest and East Texas. He won promotion to driller.

During this period Humble asked its employes at Floresville, Tex., to elect representatives to sit down with management to talk over employment problems.

Horton's fellow workers elected him to represent them, and it was then that he got his first experience in employe-relations—on labor's side.

"You'd call it collective bargaining now," he says, "but we didn't even think about collective bargaining or a union then. We thought it was fine management wanted us to sit down and talk with them."

Horton soon caught management's eye, and he was brought into the employe-relations department at Houston as a safety engineer in 1934 and later to direct supervisory training programs in the field.

The next year he moved to Tyler as the East Texas regional employe-relations manager. Except for a year in Houston as a member of the war manpower committee working with the Petroleum Administration for War, Horton stayed in Tyler 10 years.

During this decade the labor policies of the nation, under the Wagner Act, changed drastically. Discussion groups such as the one Horton once worked with gave way to unions and formal collective bargaining.

But Humble's employes did not, as a general rule, join up with national organizations. Employes in its six production divisions formed six independent unions. The same was true of the bulk of its Baytown refinery workers. In all, Humble deals

▶ ▶ ▶ Personals

R. L. Zieve, Pan American Petroleum Corp. district geophysicist, has been transferred to Denver from Bismarck, N. D.

Edward L. Steiniger, president and a director of Sinclair Oil Corp., has been named to newly-created board of lay trustees of Fordham University.

Allen C. Nelson, production engineer in New Cuyama, Calif., for Richfield Oil Corp., has been transferred to Bakersfield, Calif., as development engineer.

William T. Eastes, district geophysicist for Atlantic Refining Co., has been transferred to Oklahoma City from Shawnee, Okla.

W. C. Lenz, a general superintendent for Texaco, Inc., has been transferred to Midland, Tex., from Fort Worth.

with 19 bargaining agencies, and each works out its own contract with the company.

Horton moved in 1945 to Houston as the policy coordinator for the production department. In this capacity he participated in collective bargaining with the unions.

Then, in 1946, he won promotion to employe-relations manager, a post he held until elected a member of Humble's board of directors in 1955. His responsibilities broadened to include such things as the purchasing and general services departments.

Finally, last month Horton reached his present post at Humble. The board of directors elected the one-time roughneck a vice president.

What he does . . . Horton's department has 240 persons, but his responsibilities cover all of Humble's 17,400 employes.

He oversees such things as the medical staff, annuities and other benefits, personnel and college recruitment, research on wages and related subjects, maintenance of salary and classification records, job training, and safety.

Like other companies which have grown rapidly since the close of World War II, Humble has studied the pros and cons of decentralizing its operations.

Horton says Humble is moving slowly on this point, preferring to avoid abrupt changes while still making operations more efficient by bringing like functions together.

The 1958 recession brought a cutback of some 2,000 employes at Humble. Reorganization accounted for very little of the retrenchment. Curtailed operations "all across the company" were responsible.

Whatever the problems at Humble, Horton is a firm believer in the company's policy of keeping the loyalty and goodwill of its employes.

"You can change the complexion of a company pretty quick by feeding into it people who don't have this understanding and feeling," he says. "We think it attracts good people to us."

Sam J. Larson, coordinator of marketing organization for Continental Oil Co. in Fort Worth, will retire June 30. He joined Conoco in 1926.

Francis Porsche, John W. Shepard, and **James O. Knobloch** have been named senior research scientists at the Whiting, Ind., research laboratories of Standard Oil Co. (Ind.).

John G. Phillips, president of Woolaroc Oil Co., has moved to Tulsa from Phoenix in a change which establishes company headquarters in Tulsa. Woolaroc was organized in Phoenix last year. Phillips is the grandson of the late Frank Phillips, founder of Phillips Petroleum Co. Woolaroc has interests in Texas, Kansas, Oklahoma, and Arizona.

O. L. Furse, New Orleans division superintendent for Humble Oil & Refining Co., has been named division manager of production as part of a reorganization of the company's eastern division there. In other changes at New Orleans, **J. G. Yeager** and **P. M. McFadden,** assistant division superintendents, become division operations superintendents. **B. E. Crowder,** formerly district superintendent at Grand Isle, La., becomes division engineering coordinator in New Orleans. **R. P. Rice,** division chief clerk, becomes division administrative coordinator.

G. Dudley Strother, now chief development engineer in Tulsa for Sunray Mid-Continent Oil Co., has been named division engineer in the new Oklahoma City central division offices. **H. H. (Pat) Everett,** Oklahoma City district superintendent of the production department's gas division, will be division gas coordinator. **E. E. Patrick,** formerly western area superintendent in Oklahoma City will be drilling coordinator, and **John W. Sutherland,** proration engineer in Tulsa, becomes joint operations coordinator in Oklahoma City. **Harold Langford,** senior production equipment buyer in Tulsa will become purchasing coordinator of the new division. **R. K. Crouch,** Oklahoma City district office manager, will be division office manager for both the production and exploration division offices. In the exploration group, **Sherril Shannon,** Tulsa division geologist, and **Glen Burroughs,** Tulsa division landman, have moved to Oklahoma City in the same capacities. **Clarence Symes, Jr.,** district geologist in Roswell, N. M., has been appointed Oklahoma City division exploitation geologist, and **Erwin Pesek,** Oklahoma City district geologist, will be division regional geologist. **James Sanders,** Tulsa seismologist, has been named staff geophysicist, Oklahoma City. **E. W. (Gene) Young,** geologist in Oklahoma City, becomes division log and reserves analyst. **Gibson Martin,** title clerk, Tulsa, will be lease records man in Oklahoma City, and **J. L. Herrmann,** section head in the Tulsa offices, will be contracts man in Oklahoma City.

J. D. Lindner, formerly reservoir and valuation engineer with Oakland Corp., has joined Norman J. Clark Engineering, Dallas consulting firm, as senior associate. He will make reserve and valuation studies of primary and secondary recovery projects.

C. C. Woodward, Jr., staff engineer in Fort Worth for Continental Oil Co., has been named division engineer in Wichita Falls, Tex. **J. E. Bunch,** Bowie, Tex., district engineer, has been transferred to Fort Worth as staff engineer. **R. J. Francis,** production engineer in Hobbs, N. M., has been named district engineer in Bowie.

Dr. Alex G. Oblad, vice president in charge of research and development for M. W. Kellogg Co., has been awarded an honorary doctor of science degree by Purdue University. Oblad received a Ph.D. degree in chemistry from Purdue in 1937. Since that time he has been with Standard Oil Co. (Indiana), Magnolia Petroleum Co., and was a vice president of Houdry Process Corp. before joining Kellogg.

W. B. Sherman, president of Panoil Co. of Dallas, has been named a director of Premier Consolidated Oilfields, Ltd., and will serve as chairman of the company's operating committee in Trinidad. Panoil recently contracted to direct and manage Premier's Trinidad oil and gas properties. **Sam N. DeWitt,** former general manager of Voss Oil Co., Newcastle, Wyo., and **P. E. T. O'Connor,** general manager of Premier, will also serve on the Trinidad operating committee. DeWitt will be Premier's manager of technical operations in Trinidad.

W. J. (Sam) Garrison, Humble Oil & Refining Co., Houston, has been elected 1960 president of National Oil Scouts & Landmen's Association. He succeeds **William P. Allen,** Imperial Oil Ltd., Calgary. At its recent meeting in Austin, Tex., the group voted a change in name to International Oil Scouts Association, in recognition of several Canadian affiliated districts. The change is effective January 1. Other newly elected officers are **Pat Sullivan,** Sun Oil Co., Casper, Wyo., first vice president; **Henry Charles,** Humble Oil & Refining Co., Los Angeles, second vice president; **D. L. Fahrny,** Phillips Petroleum Co., Amarillo, Tex., third vice president; **W. Everett Florey,** Superior Oil Co., Tyler, Tex., secretary-treasurer; and **Harvey Boos,** Amerada Petroleum Corp., San Antonio, Tex., editor-in-chief.

▶ ▶ ▶ Personals

Robert D. Bent, assistant general manager of Atlantic Refining Co.'s manufacturing department, has been promoted to general manager of manufacturing. He succeeds **W. F. Stroud,** who has retired. Stroud had been vice president and general manager of manufacturing since 1952 and a director of the company since 1955. He will continue as a director. Bent joined Atlantic in 1935. He was manager of the technical service department before becoming assistant general manager of manufacturing.

BENT

Robert W. Martin has been named head of the thermoplastics department at Shell Development Co.'s Emeryville, Calif., research center.

Harry H. Young, formerly manager of Sinclair Refining Co.'s Great Lakes division, has been elected vice president and general sales manager of the company's central region. He will headquarter in Chicago. Young succeeds the late W. D. Cross, Jr.

James McDonald, Tidewater Oil Co.'s administrative manager of manufacturing, has been named assistant western division general manager. **Clifford A. Phillips,** superintendent of crude distillation, fluid coking, and catalytic cracking at Tidewater's Delaware City, Del., refinery, will succeed McDonald. The appointments are effective July 1.

H. F. van der Voort, formerly marketing operations manager in Denver for Continental Oil Co., and more recently on special assignment in Houston, has been named manager of marketing for the Rocky Mountain region. He succeeds **L. R. Kump,** who recently was named coordinator of marketing trade relations in Houston.

Morris Preidikman, formerly with Gordon Lacey Chemical Product Co., New York, has joined Vickers Petroleum Co. as assistant process engineer in the technical division. His main responsibility will be modernization and expansion at the company's Potwin, Kans., refinery. Also at Potwin, **W. L. Caldwell,** chemist, has been named project leader in charge of development projects. **J. M. Hazen,** chemist, has also been assigned to the project development group.

Charles R. Dodson, formerly vice president of the petroleum department of First National City Bank of New York, has joined California Bank, Los Angeles, as petroleum division vice president.

Charles H. Sommer, formerly general manager of Monsanto Chemical Co.'s organic chemicals division, has been elected executive vice president, a new position. He also becomes a director and member of the executive committee.

James A. Rickard, petroleum engineer with Humble Oil & Refining Co.'s eastern division in New Orleans, has been transferred to Houston as research engineer in the production research division.

Warwick M. Downing, Denver attorney and chairman of the Colorado Oil and Gas Conservation Commission, has received an honorary doctor of law degree from the University of Denver.

Dr. David W. Trexler, professor of geology at Colorado School of Mines, will act as consultant to Stekoll Petroleum Corp. in a geologic evaluation of the company's 81,000-sq.-mile concession in Queensland, Australia.

J. Brown Cutbirth, Houston independent operator, has been awarded the honorary degree of doctor of laws by Howard Payne College, Brownwood, Tex. Cutbirth is a 1923 graduate of Howard Payne.

Harold Svoboda, Sunset International Petroleum Corp.'s manager of production, has been elected a vice president. He will continue to be in charge of all oil and gas production. A graduate of the University of Southern California, Svoboda joined Sunset in 1952. He had previously been with Union Oil Co., Wasatch Oil & Refining Co., and Phillips Petroleum Co.

Howard P. Ferguson, manager of wholesale and subsidiary sales and wholesale lubricating oil sales for Standard Oil Co. (Ohio), has been elected president of Fleet-Wing Corp., marketing subsidiary of Ohio Standard. He will continue in his assignment with the parent company. **George H. Pugh,** merchandising manager for Fleet-Wing, has been elected vice president and general manager. He will be operating head of the subsidiary. Ferguson succeeds **William J. Loufman,** who will retire July 1.

R. W. Benner, geologist in Salt Lake City for Texaco, Inc., has been promoted to district geologist in Denver.

A. D. Porter, district engineer for Cities Service Pipe Line Co., has been promoted to assistant district superintendent in Oklahoma City He has been with the company since 1950.

Robert F. Owens, district drilling foreman with Atlantic Refining Co., has been transferred to Oklahoma City from Tulsa. Atlantic's district offices were recently relocated in Oklahoma City.

G. R. Hunsaker, formerly instrument shift supervisor at the Iraqi Government's Baghdad refinery, has joined McGraw-Hydrocarbon Co. in Chungju, Korea, as assistant instrument foreman.

L. W. Walker, manager of the asphalt department for Leonard Refineries, Inc., has retired. He will continue as a consultant to the asphalt department. Walker has been with Leonard for 17 years.

J. V. Montalban, formerly vice president in charge of exploration and production for Flank Oil Co., has resigned to form Montalban Oils, Inc., in Billings, Mont. Montalban will be president and managing director.

F. J. Stubbs, assistant general manager of Interprovincial Pipe Line Co., has been appointed assistant to the president of the company. He will move to Toronto from Edmonton. Stubbs was with Imperial Oil, Ltd., and affiliated companies for 17 years before joining Interprovincial. He has been with the pipeline company since shortly after its inception. Interprovincial built its original system in 1950.

E. F. Grieb, assistant plant manager at American Cyanamid Co.'s Fortier plant, New Orleans, has moved up to plant manager. He succeeds **C. F. Bonnet,** who has been named associate regional director-Europe of Cyanamid International, the company's overseas operating division. **T. D. Smith,** manager of operations at the New Orleans plant, will replace Grieb as assistant plant manager. **J. J. Fitzgerald,** general superintendent of production, succeeds Smith.

Ronald V. Dunbar, petroleum engineer with Tidewater Oil Co., has been transferred from Santa Fe Springs, Calif., to Ventura, Calif., in the same capacity.

A. J. Weith, petrochemical department sales manager for American Cyanamid Co.'s organic chemicals division, has been appointed director of petrochemicals and mining chemicals research for the division.

Elwood L. Baldwin, formerly resident petroleum engineer for Atlantic Refining Co. in Caracas, Venezuela, has been named manager of operations in the new Tulsa office of Syndicate Oil Corp., Rochester, N. Y.

Ole Berg, Jr., a former president of British American Oil Co., Ltd., and British-American Oil Producing Co., has been eleced executive vice president and a director of Sunland Refining Corp. He will headquarter in Fresno, Calif. Berg entered the oil industry in 1921 with Union Oil Co. He was vice president of Union before joining British American.

J. W. Bateman, formerly director of the new projects division of Continental Oil Co.'s coordinating and planning department in Houston, has been promoted to assistant manager of the department.

William C. Durham, Jr., formerly chief geologist with Harper Oil Co., has joined Russell Maguire, New York and Dallas oil producer, as division geologist in charge of Northern Texas, New Mexico, Oklahoma, and Kansas.

Grant W. Hendricks has been promoted to supervisor of the process research group at Union Oil Co.'s Brea, Calif., research center. **Edward P. Parry** has been promoted to senior research chemist at Brea.

E. W. (Jack) Berlin, deputy general managing director of Iranian Oil Exploration & Producing Co. and Iranian Oil Refining Co., will move up to general managing director and chairman of the board of both companies July 1. He succeeds **Koos Scholtens,** who is retiring. Berlin was formerly with Standard-Vacuum Oil Co., where he held the posts of senior engineer, head of the production department, and general representative in Jakarta, Indonesia.

C. A. Neilson, chief chemist for Continental Oil Co. in Ponca City, Okla., has been named director of laboratories there.

John Richart, geologist with Pure Oil Co., has been transferred to Earlington, Ky., from Olney, Ill.

Keith Algier, formerly with Carter Oil Co. in Durango, Colo., has joined United Western Minerals as manager of the company's new oil and gas division. He will headquarter in Durango.

Milton B. Thacker, general foreman of the mechanical department for Utah Oil Refining Co., has been elected chairman of the Utah section of American Society of Mechanical Engineers.

Joseph C. Knight, senior geophysicist in New Orleans for Sinclair Oil & Gas Co., has been promoted to division geophysicist. He succeeds **Raymond Halsey,** who recently joined Sinclair BP Exploration Co. in New York.

Ray Bromell, formerly vice president, drilling, for Kendavis Industries, has joined Jett Drilling Co., Inc., as assistant to the vice president in charge of operations. **Graham Land,** formerly with Texaco, Inc., has joined Jett as head of the land department.

▶▶▶ Personals

William B. Cleveland, a director of Creole Petroleum Co., has been elected a director of Standard-Vacuum Oil Co. Cleveland is a former manager of marketing for Creole and was also manager of the company's Amuay refinery at one time. He was a director of Carter Oil Co. before being named a director of Creole last year. Cleveland will move to White Plains, N. Y., from Caracas.

J. J. Renfro, production engineer with Phillips Petroleum Co. in Morgan City, La., has been named reservoir engineer and transferred to Odessa, Tex.

A. R. Hansen, geologist for Sun Oil Co. in Salt Lake City, and **W. B. Dodds,** geologist in the Beaumont, Tex., office, have been transferred to Billings, Mont.

Kirby Hillin, regional civil engineer for Sun Oil Co., has been appointed assistant southwest division civil engineer. He will continue to headquarter in Dallas.

▶▶▶ Deaths

John William Watson, 71, retired vice president of Shell Chemical Corp., died June 17 after a brief illness. Watson joined Shell Oil Co. in 1930. He was treasurer and vice president of the company in New York before being assigned to Shell Chemical in San Francisco. He retired in 1948.

A. D. Puckett, 50, Pittsburgh district manager for Du Pont's petrochemicals division, died June 15 in Pittsburgh after a heart attack. Puckett was with the U. S. Bureau of Mines in Bartlesville, Okla., before joining Du Pont.

David Cox, 42, partner in Cox Drilling Co., Owensboro, Ky., died recently in Bowling Green, Ky., after a heart attack.

William J. Owen, 29, Denver, president of Triton Oil Co., was killed June 15 when his private plane crashed near Gainesville, Tex. He had taken off from the Gainesville municipal airport a few minutes before the plane stalled and crashed.

Edwin C. Daniel, 66, retired plant operator for Texaco, Inc., died June 10 at his home in Davenport, Okla., after a heart attack. Daniel retired last year after 38 years with the company.

David Alexander Shepherd, 80, founder of Columbia Oil Shale & Refining Co. in Denver during World War I, died recently in Sewanee, Tenn. Shepherd sold the company to Dow Chemical Co. in 1954.

Charles E. Weller, 80, Mount Pleasant, Mich., independent, died June 8. Weller drilled his first Michigan wildcat in 1917 and was an active developer until last year.

Alfred C. Torgeson, 67, president and general manager of Torgeson Oil Co., died recently in Cheyenne, Wyo.

Don't be fooled by recent demand gains

BY JOHN C. CASPER

DEMAND for petroleum products has been showing good gains over last year, but those gains need qualifying. The increases are high because they are calculated from very low base demands in 1958.

Here is a simple analogy. If a man is standing in a hole that is 4 ft. deep, he will have to be 6 ft. tall to see over a 2-ft. fence.

Total demand for all products in May averaged about 8,760,000 bbl. daily for a gross gain of 5.5% over the total for May last year. Since exports are running a little behind last year, the gain for domestic demand is estimated at 5.9%. If the increase were measured from a normal base, it would be better than average.

But domestic demand was low in May last year. The average for the month was 8,023,000 bbl. daily for a decrease of 19,000 bbl. daily from May 1957. And even the average for May 1957 does not make a perfect bench mark because the average for that month was down 148,000 bbl. daily from the total for May 1956.

The postwar trend for domestic demand in May shows an average annual increase of about 4.7%. Based on this trend, domestic demand for all products should have averaged about 8,446,000 bbl. daily in May last year.

This throws a different light on the good percentage gain in demand for May this year. If last year's demand had been up to par of 8,446,000 bbl. daily, the estimated average of 5,500,000 bbl. daily last month would represent a gain of only 0.6%.

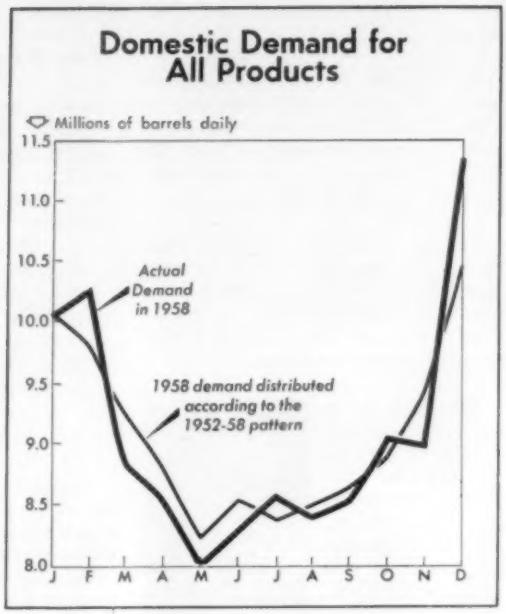
A calculated trend for May domestic demand in the postwar period through 1957 shows that 8,775,000 bbl. daily would be normal for May 1959. Normal for May 1958 would have been 8,446,000 bbl. daily compared with actual of 8,023,000 bbl. daily. The average for 1957 was very close to normal.

The low averages for the past 2 years may indicate a gradual leveling off in demand, but the total for May last year was much too low to be used as a base for calculating percentage gains in 1959.

The chart shows that the monthly breakdown of demand last year was abnormal. The heavy line gives actual domestic demand for 1958 by months. The light line shows distribution of the year's demand according to the average 1952-58 pattern. Note that the heavy line is low for the period March through June.

One reason for soft gasoline markets in May is shown in the table. Refiners turned more of their crude into gasoline than in past years, but gasoline sales represented a smaller segment of total product demand.

May gasoline yield was higher than for any other May since the end of World War II, but gasoline's contribution to total demand was lower then for 5 out of the past 7 years.



DISTRIBUTION of domestic demand by months in 1958 did not follow the average postwar pattern. Very high demand in February and December was balanced by below-normal demand in all of the summer months except July. Calculated percentage gains this year have been distorted by the abnormal distribution last year.

A quick look at the highlights . . .

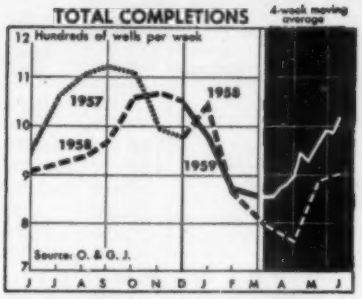
	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,999,505	DOWN	43,035	UP	649,190
Crude stocks	261,731,000	DOWN	789,000	DOWN	1,329,000
Completions	1,006	UP	28	UP	143
Refinery runs	8,020,000	DOWN	184,000	UP	361,000
Gasoline stocks	201,508,000	DOWN	2,097,000	UP	11,267,000
Kerosine stocks	26,151,000	UP	1,088,000	UP	3,192,000
Distillate stocks	106,505,000	UP	4,009,000	UP	9,811,000
Residual stocks	54,612,000	DOWN	1,003,000	DOWN	8,781,000
Four-product stocks	388,776,000	UP	1,997,000	UP	15,489,000
Total imports	1,217,600	DOWN	166,100	DOWN	286,600

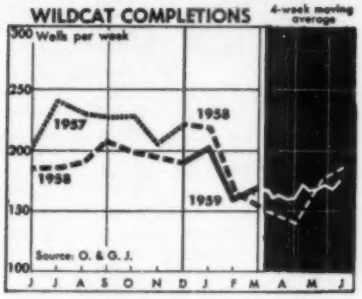
GASOLINE

Production and Demand in May
(Per cent of total)

	Refinery production*	Total gasoline demand†
1946	42.0	42.1
1947	43.0	43.1
1948	43.9	43.9
1949	49.8	49.2
1950	47.8	46.1
1951	47.1	47.2
1952‖	46.8	49.0
1953	47.1	47.3
1954	48.0	47.8
1955	48.3	48.4
1956	47.6	47.3
1957	47.9	47.8
1958	49.5	49.5
1959‡	50.2	47.7

*May production of gasoline as per cent of crude runs. †May total gasoline demand as per cent of total product demand. ‡Preliminary. ‖Jet-fuel component included prior to 1953.





Active Rotary Rigs

	6-15-59	6-8-59	6-16-58
Alabama	7	7	5
Arkansas	9	14	19
Arizona	3	3	..
California	103	104	77
Land	98	99	(*)
Offshore	5	5	(*)
Colorado	56	49	45
Florida	2	3	1
Land	1	2	1
Offshore	1	1	..
Georgia	..	..	1
Illinois	53	41	71
Indiana	7	11	11
Iowa	3	3	3
Kansas	149	140	128
Kentucky	7	8	10
Louisiana	371	380	276
North	33	33	39
S.-Inland waters	156	157	(†)
S.-Land	129	127	198
Offshore	53	63	39
Maryland	0	0	0
Michigan	26	25	6
Mississippi	67	67	39
Missouri	1	1	..
Montana	21	24	17
Nebraska	30	27	25
Nevada	1	1	..
New Mexico	138	137	129
New York	1	1	2
North Dakota	39	35	35
Ohio	2	2	..
Oklahoma	248	243	179
Oregon	0	0	1
Pennsylvania	11	9	9
South Dakota	2	2	..
Texas	791	779	639
S.-Inland waters	4	5	(†)
S.-Land	204	195	122
Offshore	1	1	3
North-East	168	161	(*)
West Central	252	255	(*)
West	162	162	(*)
Utah	30	30	37
Washington	1	1	..
West Virginia	8	8	8
Wyoming	93	90	61
Total U.S.	2,280	2,245	1,834
Western Canada	156	149	164
Eastern Canada	0	0	3
Grand total	2,436	2,394	2,001

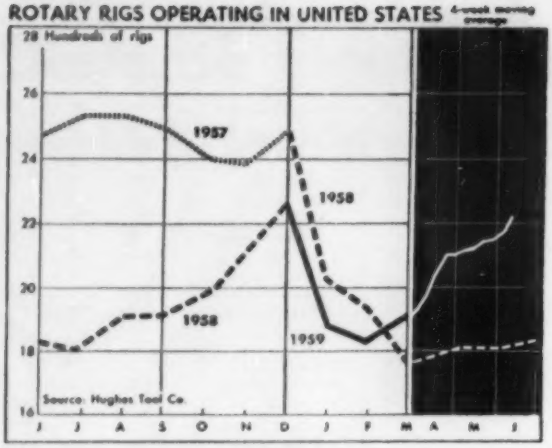
Hughes Tool Co. *Comparisons not available due to change in method of reporting. †Included in South-Land.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JUNE 13, 1959

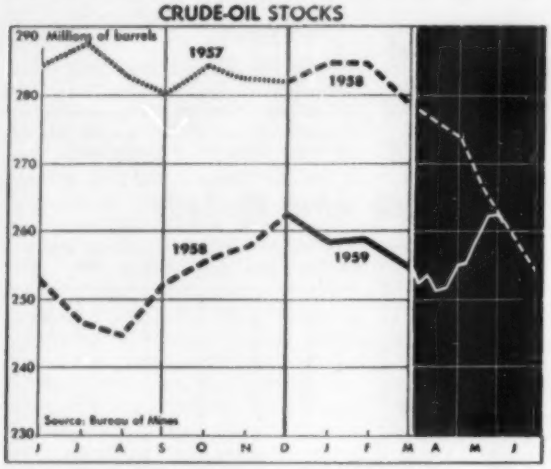
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1959	1958	Total	Crude	Cond.	Gas	Dry	1959	1958
Alabama	3	2	0	0	1	0	24,874	46	37	1	0	0	0	1	8	14
Arkansas	21	10	0	1	10	0	74,515	371	287	2	0	0	0	2	60	73
California	25	15	0	1	9	0	101,763	678	793	8	0	0	1	7	163	164
Colorado	20	3	0	3	14	0	116,898	326	329	13	0	0	1	12	193	177
Illinois	33	12	0	0	13	8	66,620	928	854	4	1	0	0	3	154	179
Indiana	14	2	0	0	12	0	25,205	323	297	0	0	0	0	4	107	115
Kansas	63	23	0	1	39	0	226,086	1,790	1,623	12	0	0	0	12	395	329
Kentucky	83	54	0	8	21	0	85,870	957	417	4	0	0	0	4	72	47
Louisiana	68	40	5	2	21	0	453,849	1,584	1,487	5	0	0	0	5	194	216
North	34	24	0	2	8	0	80,019	573	500	1	0	0	0	1	80	76
South	25	10	5	0	10	0	271,188	837	784	3	0	0	0	3	107	125
Offshore	9	6	0	0	3	0	102,642	174	203	1	0	0	0	1	7	15
Michigan	12	2	0	0	7	3	39,968	258	172	2	0	0	0	2	58	57
Mississippi	15	4	0	0	11	0	146,504	283	169	8	0	0	0	8	130	86
Montana	8	4	0	0	4	0	33,240	128	163	4	0	0	0	4	46	70
Nebraska	19	5	0	0	14	0	117,383	355	299	7	0	0	0	7	160	142
New Mexico	40	31	0	2	7	0	191,573	829	847	5	1	0	0	4	92	114
West	11	8	0	2	1	0	30,029	362	395	1	0	0	0	1	27	50
East	29	23	0	0	6	0	161,544	467	452	4	1	0	0	3	65	64
New York	0	0	0	0	0	0	0	143	249	0	0	0	0	0	13	16
North Dakota	13	9	0	0	4	0	83,033	223	195	1	0	0	0	1	45	64
Ohio	17	5	0	4	4	4	52,117	424	464	1	0	0	1	0	10	5
Oklahoma	100	49	5	10	35	1	421,317	2,611	2,970	13	0	3	0	10	398	403
Pennsylvania	0	0	0	0	0	0	0	212	184	0	0	0	0	0	3	6
Texas	394	216	18	13	140	7	1,656,140	8,597	8,142	80	6	1	0	73	1,605	1,677
Dist. 1	24	8	0	3	13	0	61,084	513	457	10	0	0	0	10	145	184
Dist. 2	13	5	2	1	5	0	79,153	361	345	3	0	0	0	3	98	90
Dist. 3	15	6	3	0	6	0	98,920	506	595	2	0	0	0	2	110	121
Dist. 4	44	14	6	4	20	0	226,503	591	557	9	0	0	0	9	149	164
East	27	18	3	0	6	0	120,383	501	551	6	0	0	0	6	103	159
Dist. 7-B	50	22	1	3	24	0	170,053	1,194	1,053	16	3	1	0	12	321	297
West	129	92	1	0	32	4	607,314	2,695	2,401	23	1	0	0	22	337	338
Dist. 9	71	38	1	1	28	3	203,143	1,626	1,623	9	2	0	0	7	289	276
Dist. 10	21	13	1	1	6	0	89,587	610	560	2	0	0	0	2	53	48
Utah	3	2	0	0	1	0	12,833	156	194	1	0	0	0	1	43	35
West Virginia	17	2	0	11	4	0	36,778	327	306	0	0	0	0	0	9	10
Wyoming	26	10	0	3	12	1	111,964	374	322	10	0	0	2	8	120	93
Misc. (Tenn.)	12	1	0	0	11	0	9,165	43	41	6	1	0	0	5	28	35
Total U. S.	1,006	501	28	59	394	24	4,087,695	21,966	20,841	191	9	4	5	173	4,106	4,127
Previous week	978	562	18	63	312	23	3,887,614	.....	.....	156	15	3	2	136	.....	.....
Cum. 1959	21,966	11,186	552	1,575	8,071	582	91,428,843	.....	.....	4,106	406	60	123	3,517	.....	.....
Cum. 1958	20,841	10,333	517	1,542	7,958	491	88,137,246	.....	.....	4,127	390	69	127	3,541	.....	.....
Western Canada	53	28	0	12	13	0	205,653	1,077	1,028	10	0	0	0	10	360	356
Ontario	0	0	0	0	0	0	0	86	.....	.....	.....	.....	.....	.....	.....	.....

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	6-6-59	5-30-59	6-7-58
Pennsylvania	2,491	2,476	2,878
Other Appalachian	1,782	1,706	1,465
Illinois, Indiana, Michigan	9,654	9,108	11,344
Nebraska and North Dakota	2,800	2,537	2,150
Kansas	9,982	10,324	10,085
Oklahoma	17,049	17,162	16,881
Arkansas	1,822	1,838	2,215
Louisiana	18,697	18,984	16,482
North	3,221	3,203	2,891
South	15,476	15,781	13,591
Mississippi, Alabama, Florida	2,260	2,373	2,066
New Mexico	8,064	8,046	7,646
Texas	114,034	115,181	111,039
East Texas	9,085	9,579	7,241
West Texas	54,937	55,063	53,093
Texas Gulf	18,385	18,692	21,849
Other Texas	31,627	31,853	28,856
Wyoming	16,427	16,523	15,557
Other Rocky Mountain	9,085	9,176	7,817
California	32,360	32,235	38,819
Foreign	†15,224	14,845	16,616
Total	**261,731**	262,520	263,060

*Bureau of Mines. †Includes 3,788,000 bbl. in California.

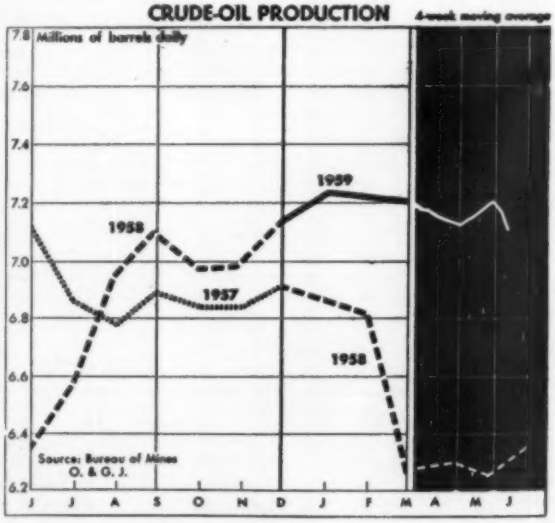
DAILY AVERAGE PRODUCTION FOR WEEK

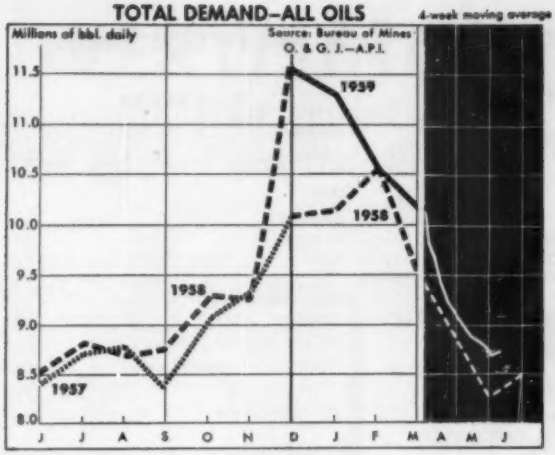
	June 13, 1959			June 6
	Crude oil	Lease condensate	Total	total
Alabama	16,150	.....	16,150	16,150
Arkansas	80,650	200	80,850	80,800
California	843,800	.....	843,800	842,500
Colorado	128,300	.....	128,300	128,000
Eastern	41,800	.....	41,800	43,600
Florida	1,300	.....	1,300	1,175
Illinois	212,000	.....	212,100	211,900
Indiana	31,000	.....	31,000	31,500
Kansas	†328,120	.....	†328,120	†320,815
Kentucky	70,900	.....	70,900	65,500
Louisiana	869,250	105,150	974,400	973,575
North	111,750	5,150	116,900	116,800
South	757,500	100,000	857,500	856,775
Michigan	26,800	.....	26,800	26,800
Mississippi	126,250	4,575	130,825	129,500
Montana	80,000	.....	80,000	79,500
Nebraska	61,800	.....	61,800	61,000
Nevada	100	.....	100	100
New Mexico	289,000	4,300	293,300	294,300
North Dakota	31,000	.....	31,000	30,100
Oklahoma	†549,400	.....	†549,400	†542,700
Texas	2,575,000	71,625	2,646,625	2,708,350
Dist. 1	43,500	2,900	46,400	46,550
Dist. 2	109,500	7,700	117,200	120,775
Dist. 3	352,000	35,000	387,000	392,150
Dist. 4	178,000	8,800	186,800	191,375
Dist. 5	29,000	350	29,350	30,200
Dist. 6	109,000	6,500	115,500	118,350
East Texas field	141,000	.....	141,000	146,425
Dist. 7-B	132,000	100	132,100	134,375
Dist. 7-C	122,000	3,625	125,625	129,625
Dist. 8	1,048,000	4,000	1,052,000	1,084,000
Dist. 9	205,000	1,800	206,800	207,375
Dist. 10	106,000	850	106,850	107,150
Utah	112,800	.....	112,800	114,500
Wyoming	338,000	.....	338,000	340,000
Others	‡135	.....	‡135	‡175
Total U. S.	6,813,655	185,850	**6,999,505**	7,042,540
Change from previous week, down			**43,035**	
Canada	†460,300	.....	†460,300	†419,900

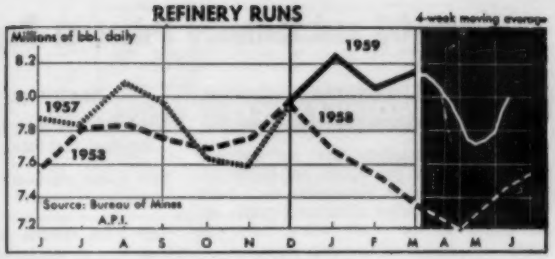
Total U. S. prod.—Jan. 1-June 13 ..... 1,176,993,730 bbl.
Same period last year (crude plus cond.) ..... *1,061,845,720 bbl.

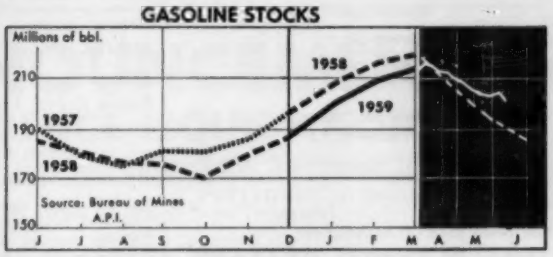
*Includes 26,854,175 bbl. condensate. †Week ended previous Monday. ‡Arizona, South Dakota, and Washington.

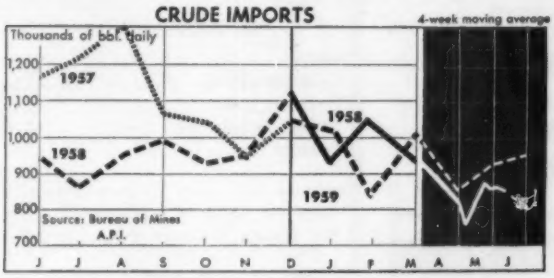
CRUDE-OIL PRODUCTION

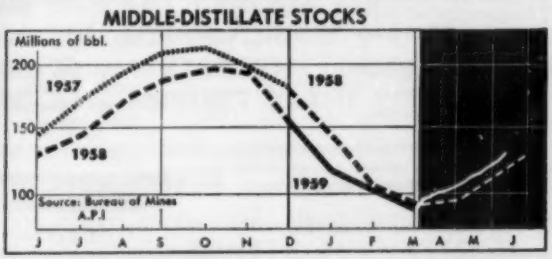


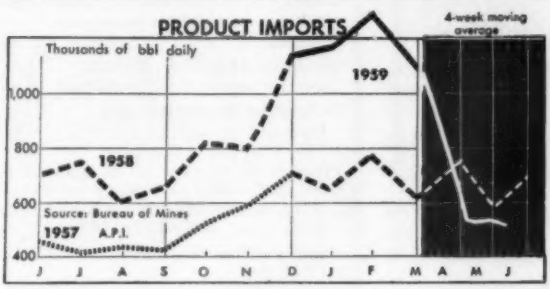


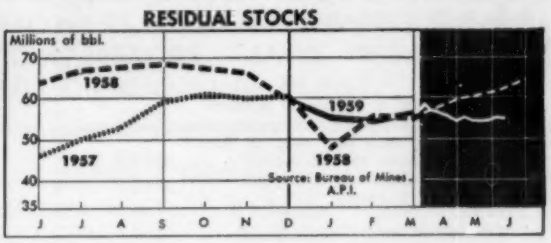












API REFINERY REPORT—JUNE 12, 1959

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, June, 1958 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,009	502.1	19.1	274.0	189.6	47,711	9,916	37,587	12,419	1,093	497.9	20.1	285.4	171.9
Appalachian:														
Dist. 1	105	46.6	4.0	22.1	8.3	5,513	539	2,191	303	94	42.2	2.5	21.6	5.8
Dist. 2	106	52.6	3.0	23.3	8.0	2,621	465	1,022	188	108	55.4	5.7	17.3	7.3
Ind., Ill., Ky.	1,475	746.2	66.9	286.1	159.4	35,194	5,154	16,455	4,009	1,373	718.9	60.3	265.0	124.5
Minn., Wis., Dak.	112	54.9	7.9	26.6	12.7	7,051	738	4,069	378	109	53.0	5.7	28.4	10.0
Okla., Kans., Mo.	752	402.6	17.7	181.7	25.6	18,991	1,191	7,365	735	742	416.4	12.5	174.9	25.5
Inland Texas	298	196.7	9.7	47.6	22.7	7,374	325	1,366	2,068	272	192.9	5.3	45.3	18.2
Texas Gulf Coast	1,843	1,004.4	96.2	449.1	164.0	25,721	3,837	13,938	4,930	1,633	839.3	68.4	382.6	178.6
La. Gulf Coast	744	406.4	39.4	176.6	39.6	11,445	2,643	5,782	1,564	613	362.0	38.2	149.2	45.0
N. La. and Ark.	90	36.1	2.3	22.9	6.3	4,242	591	1,925	159	100	41.7	4.3	25.5	6.6
Rocky Mountain:														
New Mexico	25	10.6	0.3	5.0	3.1	724	52	156	116	27	13.5	0.5	5.1	2.5
Other Rocky Mt.	317	146.4	3.4	63.4	32.4	5,996	257	2,130	1,131	294	134.6	3.5	61.1	30.7
West Coast	1,144	489.7	9.0	176.9	271.9	28,925	443	12,519	26,612	1,069	485.6	5.6	150.0	284.8
June 12, 1959	8,020	4,095.3	278.9	1,755.3	943.6	201,508	26,151	106,505	54,612	7,527	3,853.4	232.6	1,611.4	911.4
June 5, 1959	8,204	4,164.6	279.4	1,811.9	1,020.1	203,605	25,063	102,496	55,615	.....	.....	.....	.....	.....
June 13, 1958	7,659	3,851.4	266.7	1,659.0	922.7	190,241	22,959	96,694	63,393	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):

Regular (89 octane)	11.375-11.75
Premium (99 octane)	14.375-14.75

Gulf Coast (cargoes for coastwise or export movements):

Regular (90 octane)	9.75-10.00
Regular (92 octane)	10.00-10.25
Premium (98 octane)	11.125-11.375

California (rack) (Los Angeles):

Regular (88 octane)	12.00
Premium (94 octane)	13.00
Premium (100 octane)	14.50

Caribbean area (cargoes):

Regular (87 octane)	9.625
Premium (97 octane)	11.25

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:

Grade 26-70	4.5

Breckenridge:

Grade 26-70	4.0

*If 26-70 natural is considered as 100%, prices for lower-vapor-pressure grades increase 2.5% for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):

★ Kerosine 42-44	9.50-9.75
★ Diesel oil (58 d.i. and above)	9.25-9.50
★ Distillate No. 1	9.25-9.50
★ Distillate No. 2	8.25-8.75

Gulf Coast (cargoes):

Kerosine 41-43	8.75
Distillate No. 2	8.25

New York Harbor (barges):

Kerosine 41-43	9.90
Distillate No. 2	9.40
Diesel fuel, 48-52 d.i.	9.65

Caribbean area (cargoes):

★ Distillate No. 2	8.25

WAX (LB.)

Oklahoma (Group 3):

132-135 A.m.p. (semi-refined) in tank car	6.50

New York (export):

126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):

Residual fuel (max. 1% S)	$1.85-2.00

Gulf Coast (cargoes):

Bunker C fuel	$2.00

New York Harbor (barges):

Bunker C fuel	$2.37

Caribbean (cargoes):

Bunker C	$2.00

California (rack):

Bunker C fuel, Los Angeles	$2.15

LUBRICATING OILS

Mid-Continent (Group 3):

150-160 bright stock, solvent refined, 0-10 pp., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 pp., 95 v.i.	20.5

Pennsylvania Grade:

145-155 vis. at 210, bright stock, 8 color, 25 p.t.	22
200 vis. neutral (180° at 100°), 25 p.t.	21

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	Gulf Coast Tex.*	West Tex.† N.M.	Wyo. (sour)
14-14.9	$1.86	....	....	....	....
15-15.9	1.95	....	....	....	$1.81
16-16.9	2.04	....	....	....	1.86
17-17.9	2.13	....	....	....	1.91
18-18.9	2.23	....	....	....	1.96
19-19.9	2.32	....	....	....	2.01
20-20.9	2.41	$2.49	....	$2.35	2.06
21-21.9	2.50	2.52	....	2.38	2.11
22-22.9	2.60	2.55	....	2.41	2.16
23-23.9	2.69	2.58	$3.44	2.44	2.21
24-24.9	2.78	2.61	3.46	2.47	2.26
25-25.9	2.84	2.64	3.48	2.50	2.31
26-26.9	2.90	2.67	3.50	2.53	2.36
27-27.9	2.95	2.70	3.52	2.56	2.49
28-28.9	3.01	2.73	3.54	2.59	2.54
29-29.9	3.07	2.76	3.56	2.62	2.59
30-30.9	3.12	2.79	....	2.65	2.63
31-31.9	3.20	2.82	....	2.68	2.67
32-32.9	3.27	2.85	....	2.71	2.71
33-33.9	3.34	2.88	....	2.74	2.75
34-34.9	3.41	2.91	....	2.77	2.79
35-35.9	3.47	2.94	....	2.80	2.83
36-36.9	3.52	2.97	....	2.83	2.87
37-37.9	3.56	2.99	....	2.86	2.89
38-38.9	....	3.01	....	2.89	2.91
39-39.9	....	3.03	....	2.92	2.93
40-40.9	....	3.05	....	2.95	2.95

*Low cold test crude. †Sour.

Effective dates of broad changes: California, 1-26-59; East of California, January 3-10, 1957; Pennsylvania Grade 4-1-59.

FLAT PRICES

Louisiana:

Sweet Lake	$3.00

Texas:

East Texas	3.25
Conroe	3.53
Van	3.08

Pennsylvania Grade:

Bradford	4.25
Middle District	4.07
Southwest Pennsylvania	3.80
★ West Virginia	3.62
Buckeye Grade	3.47

Illinois Basin	**3.00**

FOREIGN

Canada:

Leduc-Woodbend	2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38

Venezuela:

Cumarebo, 48°-49.9°, Tucupido	3.34
San Joaquin, 41°-41-9°, Puerto La Cruz	3.08-3-10
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° very 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes f.o.b. lifting port):

Arabian, about 34°, Ras Tanura	$1.89
Iranian, 34.0°-34.9°, Bandar Masur	1.86
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05

Middle East, E. Mediterranean:

Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29

Far East (cargoes, f.o.b. Lutong, Sarawak):

Seria Light, 37°	2.57

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

Gulf-USNH, clean (ATRS—35%)	$1.85
★ Carib.-USNH, dirty (ATRS—60%)	1.10
★ PG-Gulf, dirty (USMC—65%)	5.09
PG-USNH, dirty (USMC—75%)	3.18

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GAS COMPRESSORS: Clark RA-4, 400 HP; Clark RA-32, 300 HP; Ingersoll-Rand XVG-8, 330 HP; 10¼" x 10½" CD-105 Cooper-Bessemer compressor cylinders. Alfred B. Kern, 305 Kennedy Bldg. Tulsa, Oklahoma.

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22,000' 5" OD USED P. E. R-2 J-55 14.87# SEAMLESS PIPE
6,500' 2⅞" OD HYDRILL DRILL PIPE. HAVE TUBOSCOPED RECORD
1—150 TON B.J. HOOK
1—IDECO 5 SHEAVE CROWN BLOCK GROOVED FOR 1¼" LINE
1—B.S. & B. 1,500# TEST 2 STAGE HORIZONTAL SEPARATOR. JUST LIKE NEW

FAIRWAY PIPE & SUPPLY CO., INC.
3943 Greenwood Road, Shreveport, La.,
—Phone 6-1861—

65,000-FT. 12¾" O.D.

.375 wall, 49.56# used lapweld line pipe, P.E. beveled for welding, cleaned, straight, single random lengths.

Suitable for piling or line pipe.

Located Chicago area. Could be shipped by rail or barge.

MID-STATES PIPE AND SUPPLY CO. OF LOUISIANA
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NATIONAL 50 located in San Juan County, N. M.

NATIONAL 50 located in Park County, Wyo.

NATIONAL 75 located in Lincoln County, Wyo.

All in excellent Condition. Inventory sent on request.

BOX L-373
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA

FOR SALE EQUIPMENT **FOR SALE EQUIPMENT**

ANNOUNCEMENT

REFERENCE LIQUIDATION

MODERN 37,500 BBL. REFINERY, DESTREHAN, LA.

(10 miles north of New Orleans)

★ **19,000 BBL. CAT CRACKER (1953)**
★ **6,000 BBL. HYDROFORMER (1953)**
★ **2,000 BBL. ALKYLATION (1953)**
★ **6,000 BBL. ASPHALT PLANT**

We are now prepared to mail a complete catalog, covering detailed specifications of all items including: BOILERS, FURNACES, VESSELS, TOWERS, HEAT EXCHANGERS, PUMPS, COMPRESSORS, TANKS, GREASE PLANT, OIL CANNING PLANT.

FEATURE ITEMS:

5—B & W Boilers. 70,000 #/hr. 500 psi. (1952).

150—80,000-55,000-15,000-10,000-5,000-3,000-1,000 Bbl. Tanks.

4—5,000 bbl. Hortonspheres.

3—10,000 bbl. Hortonspheroids.

112—Towers & Pressure Vessels, from 2' up to 12' dia. and 30' to 110' high.

100—Heat Exchangers, from 78 to 6,100 sq. ft.

3—Clark HMA-8 & HMA-4, 330 hp., & 165 hp., right angle gas engine compressors.

1—IR 2-stage compressor type HHE-2, 3,170 cfm., 125 psi., 600 hp. synchronous motor.

1—Carrier 38,300 cfm. centrifugal compressor, 32.7 psi., 3,370 hp. Turbine.

1—Carrier 9,370 cfm. centrifugal compressor, 124.7 psi., 2,310 hp. Turbine.

5—Furnaces 1,300 to 2,200 sq. ft. Heating Surface.

6,000 Tons of Pipe up to 16" dia.

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FOR SALE—National 50 rig in Four Corners area. Inventory on request. Also 127' Lee C. Moore mast, C-250 pumps, rotary table, drill pipe, & misc. equipment. Hi-Z Rental Tool & Supply Co. Ph. LO 5-8612, Box 476, Cortez, Colorado.

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FOR SALE—South Texas Area. CAPACITY: 5.2 MMCFPD at 350 psig. with 40 grains per 100 SCF. This Unit is approximately 3 years old and can be obtained for approximately 50 per cent of replacement value. This Unit can be inspected by contacting:

REPUBLIC NATURAL GAS COMPANY
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Corpus Christi, Texas.

FOR SALE EQUIPMENT

FOR SALE—8 Clark gas engine compressors, size RA-8, RA-6, RA-4, RA-3. Box L-305, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE—3 miles 2" line pipe, 127' Mast 7' Substructure, 131' Mast 11' Substructure, one 3 motor unit drawworks, one two motor unit drawworks, Waukesha engines. Call CEntral 2-6318, Oklahoma City.

BUCYRUS-ERIE 36L—Late model skid mounted Cummins Diesel 150 H.P.-4000 Ft. ⅞ and ¾ lines. Safety lights on rig—3 complete strings of tools and bailers, doghouse, diesel light plant forge attached. Flooring, hand tools. Priced to sell. W. H. Obins, Fairfax, Oklahoma or W. G. Obins, Shidler, Oklahoma.

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NEED PIPE? 8" Steel, Wt. 28 lbs., beveled for welding, straight machine cleaned, coated, strictly No. 1 grade. Pittsburgh Testing Lab. report furnished. Indiana-Ohio Pipe Co., P. O. Box 323, Phone 3-4674, Decatur, Indiana.

500,000 FT. 10¾" O.D. 35-40# No. 1 grade, machine cleaned, plain end, random lengths, straight, coated, price $1.85 a ft. f.o.b. cars Columbus, Ohio. Central Ohio Pipe Co. Phone 3-3377, Decatur, Illinois.

FOR SALE—New spare parts for type KVG 60 hp. gas engine compressors. Including: Power cylinders, liners, inlet & discharge valves, piston rods, shoes, oil coolers, etc. Price right. Send for complete list. Brill Equipment Co. 2401 Third Ave. New York 51, N. Y.

1958 BEECHCRAFT E-18S. Will sell or enter into 4 or 5 year lease with option. Gene Tumbleson, Box 271, E. Alton, Illinois. Phone 9-6437, Night 4-8185.

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20 TOWERS from 2'6" to 16' Dia., 20' to 145' high up to 300 psi	HEAT EXCHANGERS and CONDENSERS 100 to 4,600 sq. ft.
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- 5—500 HP RA5 Clark Gas Engine Compressors 17"x14"
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- 41,400 CFM I.R. Turbo Blower 28.2 psi. 3,000 HP. Motor
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New York Office—60 East 42nd Street, New York 17, N. Y., MUrray Hill 7-5280
Tulsa Office—306 Thompson Bldg., Tulsa 3, Okla. Diamond 3-4890

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8⅝" O.D. NEW LINE PIPE

15,524 ft.—New Electricweld Prime Grade, A.P.I. Spec. 5L-X52, .277 Wall, 24.70# P. E. Beveled, average 46 ft. lengths, located: Kinder, La.
Moody Inspection Certificates Available.
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310C AVAILABLE IMMEDIATELY

Will sell or enter into a 4 or 5 year lease with option.

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NEW STEEL LINE PIPE
BELOW MILL PRICES

Prime API 5L, Grade B, 34' lengths. Beveled Ends
115,000'—4½" O.D. x .188 wall x 8.64# E.R.W.—1800# P.S.I.
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Twenty Miles of it!

6⅝" O.D. x 12.89# x 188" wall, American-made, mill tested 1200#, Grade B, Electric Resistance Weld; plain ends, beveled for welding. Bare pipe—coating and wrapping can be arranged if desired. From warehouse stock—immediate shipment.

Offered, while it lasts, at our lower-than-mill price of $1.04 ft., f.o.b. Ohio.

We also stock ALL SIZES of new Steel Pipe up to 36". Get our money-saving low prices on all your pipe needs . . . write.

Box L-386,
The Oil and Gas Journal,
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NEW IDECO RIGS AND MACHINERY
RECONDITIONED AND USED MACHINERY
USED RIGS

NEW 23" Ideco Rotaries. Liberal allowance on your old table.
NEW BJ 2¾" x 96" Elevator Links . . . 4½" Type MAA Elevator . . . 460 Hook. Will accept your old equipment in trade.
NEW 2,500' 4" O.D. Grade D Plain End EUE Drill Pipe, Special Price. Located Oklahoma City.
RECONDITIONED Martin-Decker Weight Indicators. A real saving here.
USED National T-25 Rig with GM Diesel Power . . . 97' Lee C. Moore Mast . . . 7¼" x 12" Pump . . . Up to 6,000' 4½" O.D. Drill Pipe. Located North Dakota.
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USED Unit U-34 Trailer Mounted Rig with Gas-Butane Power . . . 94' Lee C. Moore Mast . . . 7¼" x 14" Pump . . . 5,000' 4½" O.D. Drill Pipe. Located Texas Panhandle.

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Oklahoma City—Woodward, Oklahoma • Dallas—Odessa, Texas

RIGS FOR SALE: U-15 Drawworks, Waukesha Motors, 127' Moore Mast, 7' Substructure, 14" Oilwell Pump, 6,500' Grade E Drill Pipe, Mud Tanks. U-15 Drawworks, Waukesha Motors, 131' Moore Mast, 11' Substructure, 16" Gardner-Denver Pump, Steel Mud Pits, 8,000' Grade E Drill Pipe. Located near Liberal, Kansas, now running, both rigs complete, inventory on request. CEntral 2-6318, Oklahoma City.

FOR SALE, Public Utility, Natural Gas, Individual Ownership. Gross $100,000 annually. Guaranteed supply of Gas. For particulars Write Box No. 226, Canton, Ohio.

3,200'—3" Drill pipe, located Seminole Oklahoma. 1 Horizontal Separator, 500# Wkg. Press Located Cement Oklahoma. Markwell Drilling Corp., 111 N W 23rd St., Oklahoma City, Oklahoma. JAckson 8-5896.

1800 FT. DRILL PIPE @$1.75, WAK Waukesha engine with Twin Disc Clutch—good condition, $1,875.00 4½ x 40 ft. Kelly with National Bushings $300.00, located in Cleveland, Oklahoma, Phone 609, Cleveland, or GI 7-0323, Tulsa.

OIL WELL FRACTURE
AND CEMENTING TRUCK
with pumps, etc. Sacrifice. Private Party. Dealers welcome. 1531 Kenneth Road, Glendale, Calif. CH 5-5917.

NEW 4" LINE PIPE
(Immediate Delivery)

120,000 ft. 4½" O.D. .188 Wall, 8.64 lb. ERW Line Pipe, API 5-L Grade B, DRL Beveled. Located Houston, Texas. Price under mill.

MID-STATES PIPE AND SUPPLY CO.
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Tulsa 1, Oklahoma

FOR SALE
7,000 gallon complete
TANK CARS
Priced Attractively
Complete tank cars or will remove tank. Can be inspected now at Kansas City.
Write • Wire • Phone
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2nd & Riverview
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EQUIPMENT WANTED

USED HIGH PRESSURE pumps in various Capacities. T. W. Covington Box 385, Bowling Green, Ky.

CORE ANALYSIS equipment, Box 1388, Wichita Falls, Texas.

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6" and 8" LANDIS
PIPE THREADING MACHINES
Please furnish model number and head numbers with offer.
VALLEY STEEL PRODUCTS CO.
Frank Corgiat—PRospect 3-3020
St. Louis 4, Missouri

HELP WANTED

ENGINEERS—Electrical and Petroleum: Expanding Wire Line Well Service Company, located in Appalachian area. Experience in well logging desirable, opportunity for advancement. Inquiries will be confidential. Submit resume of experience and education to P. O. Box 22, Apollo, Pa.

NEW OIL EMPLOYMENT Directory, foreign and domestic, showing where to apply for jobs. 500 selected producing, refining, LPG and pipeline companies. Nationwide $7.50 cash. OIML Co., Box 2603, Tulsa, Okla

Chemical Plants
Operations Superintendent and Division Manager

Well established company, a manufacturer and operator of chemical processing plants, requires two men with over 5 years' solid experience typically found among PLANT MANAGER in chemical producing plants or petroleum refineries.

These assignments in our Eastern and Southern Divisions requires experience covering "star-up" of new units, including familiarity with hiring, training and supervising new key personnel . . . as well as with cost control, labor relations and sound management techniques.

ChE degree desired. Send resume in strict confidence.

Box L-375,
The Oil and Gas Journal,
Tulsa, Oklahoma

HELP WANTED

PRODUCTION ENGINEER: Growing independent oil company has opening for graduate petroleum engineer with minimum of 4 to 6 years completion and production experience, preferably in Gulf-Coast, Mid-Continent areas. Work will be in north and west Texas, central Oklahoma, and north and south Louisiana. Age: 25 to 35. Salary commensurate with experience. Submit complete resume of experience and education to: Box L-368, The Oil and Gas Journal, Tulsa, Oklahoma.

Attention Canadians
Refinery Chief Chemist

Applicants should have held a position in responsible charge of a refinery laboratory. Experience in asphalt testing and blending desirable. Send resume to:

Phillips Petroleum Company,
Dawson Creek Refinery,
P. O. Box 60, Dawson Creek,
British Columbia.

Production Engineers

Well known expanding major oil company has openings in district offices of domestic oil and gas producing operation. Minimum of three years production experience required; water flood experience desirable. Response should include salary expected and complete resume of education and experience. Our employees have been informed of this advertisement.

Box L-309,
The Oil and Gas Journal,
Tulsa, Oklahoma.

CHEMIST OR ENGINEER

Having knowledge of petroleum refining and proved ability to write. Will write monthly digest of new developments in fuels, lubricants, petrochemicals, etc., and the processes used to make them. Other technical writing for wide circulation. Also editing of such material. Creative, top-level job. Send resume to:

Personnel Manager,
Ethyl Corporation,
1600 West Eight Mile Road
Ferndale 20, Michigan.

CHIEF ENGINEER

Large Southern California independent oil company with modern refinery and excellent growth prospects needs chief engineer. Under general direction of Manager of Manufacturing will be in direct charge of all refinery engineering activities, including design, inspection, construction and maintenance. B.S. degree in Engineering is necessary, preferably mechanical. Must have minimum of five years experience in refinery engineering activities including supervisory and administrative responsibilities. Prefer some experience in medium to small refinery organizations. Age 32—40. All replies confidential. Send complete resume of experience and qualifications, snap-shot and salary requirements to:

Personnel Manager
WILSHIRE OIL COMPANY OF CALIFORNIA
P. O. Box 2487,
Santa Fe Springs, California

HELP WANTED

ENGINEER with experience in thermal and mechanical design of fired heaters for use in the Petroleum and Petro Chemicals Industry. Phone or wire: Max Brady, 3515 Dawson Road, Tulsa, Oklahoma, WE 9-6371.

PETROLEUM ENGINEERS (2) under 32 for North Louisiana and Dallas, Texas, locations. Minimum five years experience in secondary recovery, reservoir, and/or unitization, and general production engineering. Send detailed resume, transcript of college work, and small photo to Box L-354, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY MAINTENANCE ENGINEER, with at least two to three years experience willing to develop into maintenance supervisor for modern refinery in mid-continent area. Our employees have been informed of this advertisement. Box L-377, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED GEOLOGIST with minimum five years experience; Louisiana—Texas areas. Age under 32. Location Dallas, Texas. Send detailed resume, transcript of grades, snap-shot and salary desired to Box L-383, The Oil and Gas Journal Tulsa, Oklahoma.

WATER FLOOD
EQUIPMENT DESIGN ENGINEER

Graduate mechanical or petroleum engineer with four years experience in water flood or secondary recovery projects. Large company. Excellent employee benefits. Age 28-45. Submit resume to:

BOX L-376,
THE OIL AND GAS JOURNAL,
TULSA OKLAHOMA.

TOOLPUSHERS
FOR
SOUTH AMERICA

Drilling contractor needs toolpushers with prior foreign experience for Colombia and other countries in South America. To age 45.

Mail Application to:

3814 N. SANTA FE
OKLAHOMA CITY, OKLA.

SITUATION WANTED

LANDMAN—35, family man. Twelve years experience as company employee and independent. Practical knowledge geology. Desire work. Will relocate. Box L-372, The Oil and Gas Journal, Tulsa, Oklahoma.

MECHANICAL ENGINEER, BS, Licensed. Diversified experience in estimating, piping, pressure vessel and structural design. Supervisory experience in refinery maintenance and construction. Desires responsible position. West or Southwestern location preferred. Box L-368, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER: 8-years experience; design, sales, fabrication, lease equipment. Presently chief engineer, leading tank company. Desires change. Box L-374, The Oil and Gas Journal, Tulsa, Oklahoma.

MANAGEMENT

Former drilling contractor with 25 years experience in drilling, production, exploration and acquiring oil and gas production for his own account, desires connection with either individual, group, or company that needs management, supervision and future exploration direction. Last 15 years in West Texas and New Mexico. Location unimportant if justifiable.

Either domestic, foreign or both.

Would desire opportunity to participate in future exploration and development. Have qualified geological and exploration staff.

R. MAKIN
P. O. Box 1833 Hobbs, New Mexico

SITUATION WANTED

FIFTY-SIX YEAR OLD lawyer, in perfect health, 35 years experience in the oil and gas industry, speaks fluent Spanish, wishes connection in field of public relations anywhere in the Americas. Well known and accepted throughout Latin America. Ready for immediate assignment. Box L-371, The Oil and Gas Journal, Tulsa, Oklahoma.

COMMERCIAL PILOT w/multi & Instrument ratings, 4 years experience accounting & Bookkeeping; write 4515 Lake View, Wichita Falls, Texas. PH 692-0708, E. R. Brown.

MR. OIL MAN—Independent Geologist available for retainer. Permanent offices in Shreveport. Proven oil finding ability. Box L-385, The Oil and Gas Journal, Tulsa, Oklahoma.

EMPLOYED INSURANCE Safety Engineer, 5 years experience, desires Oil Industry Connection. Drilling, refining exploration, industrial, fleet experience; 3 years CE major, 20 hours Geology, Personnel degree Texas University. Box L-389, The Oil and Gas Journal, Tulsa Oklahoma.

GRADUATE ENGINEER, 29—Desires to manage overseas or domestic drilling and production programs. 17 years diversified experience drilling, production, and exploration overseas and domestic. Fully qualified to provide capable, agressive, technically up to date leadership. Speak Spanish. Excellent references. Box L-390, The Oil and Gas Journal, Tulsa, Oklahoma.

FLUENT SPANISH translator, interpreter and bi-lingual secretary. (Valladolid, Spain, University diploma) English born woman with many years excellent business experience London and Madrid. Seeks responsible and interesting position preferably Venezuela or other Latin country. K. Chuck, Apartado 14.037, Madrid, Spain.

LEASE AND DRILLING BLOCKS

4,700 ACRES in one block, Wayne County Kentucky. Surrounded by oil & gas test of over 50 years ago when oil was 50c a bbl. with no market or pipe lines, a proven shallow well area 25c rented long lease. $7.50 per acre with 1/8 over ride; $5.00 per acre with 1/8 over ride; $3.50 per acre with 1/8 over ride: Box L-388, The Oil and Gas Journal, Tulsa, Oklahoma.

CUMBERLAND COUNTY KENTUCKY—212 acres, 5 yr. term. Annual rental. $1.00 per acre. Shallow production adjoining two sides. Price $30.00 per acre, 1/8 over ride. Write, wire, phone Luther L. Shepherd, Burkesville, Ky.

140 ACRES, producing 28 bbl./day, adjoining Major Company flood. Cored test hole shows 34,750 barrels per acre total oil. $22,000 cash, $48,000 oil payment. Box L-392, The Oil and Gas Journal Tulsa, Oklahoma.

FOR SALE—200 acres Ky. oil lease near oil field never been drilled on also small, farm and house. Would take small drilling rig for part payment—Grover Railey, P. O. Box 216 Tompkinsville, Ky.

Caddo-Pine Island Field

160 acre federal oil and gas lease, full five year term, in T. 21 N., R. 16 W., La. Mer, S½SE¼, Sec. 2; and E½SE¼, Sec. 11. High bidder at federal auction will assign outright or with small override.

Box 7387 Phone
Washington 4, D. C. NAtional 8-7377

LOOKING FOR OIL???

Two leading Core Laboratories, in detailed CORE ANALYSIS, show 40,000 BARRELS OF OIL PER ACRE at the shallow depth of 300 feet in the Bartlesville Sand, 27 gravity, Mid-Continent Area. Geological report has SURFACE, SUB-SURFACE, ISOPACH OF SAND, PROFILE, CROSS SECTION AND STRUCTURE. Thermal and Insitu Combustion process recovery projects now being initiated by oil companies on this acreage. LIMITED AMOUNTS of five year lease acreage offered at $50.00 per acre plus 10% Override Royalty.

BOX L-393,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

LEASE AND DRILLING BLOCKS

I WILL DRILL your shallow prospect or buy your producing interest. U. S. Andersen, 8350 Santa Monica Blvd., Los Angeles 46, Calif.

LEASING 450 ACRES of oil lands in Trinidad British West Indies—For information write to Albert Edwards, 9647 Wentworth Ave., Chicago 28, Illinois.

KENTUCKY-SHALLOW drilling 600 acres with merit near HEGIRA and Cumberland-Clinton County border. Long term, low rental. Price $7.50 per acre 1/8 override. Inspection invited. W. V. Cravens Russell Springs, Kentucky.

SELL ONE-HALF interest 400 acre lease. Old wells come in making 150 barrels 40 years ago. Should be big shallow producers 450 feet. P. O. Box 117 Greensburg, Ky.

WORKING INTERESTS up to 1/2 for sale. Chautauqua Co., Kansas. 150 acres offset to free flood and new well 1,100 ft. sand. Box L-328, The Oil and Gas Journal, Tulsa, Oklahoma.

80 ACRE LEASE between two floods. Major Co. 1/2 mile one way, abuts flood the other way. 3 stripper wells, producing 3 bbl./day. $10,000.00. Box L-391, The Oil and Gas Journal, Tulsa, Oklahoma.

4,500 ACRE FARMOUT available near refineries and large major acreages; Roads, railroad, water transportation. Excellent geology, soft drilling. Will sacrifice. Box 31 R 407, The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles 8, Calif.

WORKING INTEREST up to 7/8 for sale, price only $375 per 1/8 to drill shallow Dutcher zone well on Southern extension of the Gladys Belle oil pool located in Pleasant Valley. Plat and details, write L. Snavely, Geologist, Box 315, Cowets, Oklahoma.

40,000 ACRES 10 year oil and gas leases on structures Western Missouri. Geology from well logs, magnetometer, surface, etc. Ownerships abstracted. Production indicated from Lamotte (Reagen), and Granite Wash. Will assign to Major or sufficiently financial rated Independent for production program, for drilling committments to granite wash, and overriding royalty. Box L-394, The Oil and Gas Journal, Tulsa, Oklahoma.

40 ACRES READY to drill. 90-ft. of Bartlesville Sand, 1/4 working interest for sale. Excellent geology. Write: Box L-393, The Oil and Gas Journal, Tulsa, Oklahoma.

NEED GOOD Oklahoma leases and royalty for my clients. Box L-395, The Oil and Gas Journal, Tulsa, Oklahoma.

PARTICIPATE in financing development of shallow proven lease. Two pay sands, chance for dual producer. For map and information contact: J. E. McAlpine, 7442 E. First, Tulsa 12, Oklahoma.

FOR SALE— in Oklahoma: 40 acres in 18/3/19 Latimer County; 80 acres in 9/5/21 McCurtain County; 20 acres in 24/16/14 Okmulgee County. C. Cohn, 3900 Walnut Grove Road, Memphis, Tenn.

TAX DOLLARS WANTED

To drill proven gas-distillate wells 8,600 ft. inside locations, off-set wells dualed and tripled completions, additional tested sands behind the casing Texas Gulf Coast. Frio sand production. Complete engineering reports. Principals only. Bank references exchanged. Phone:
EL 2-3352, Taylor, Texas
HI 4-1393, Austin, Texas
OGDEN OIL COMPANY
P. O. Box 464, Taylor, Texas.

ROYALTIES

OFFERING OIL AND GAS Income Royalties and those ahead of drilling. A. S. Berry, 109 Midco Bldg., Tulsa, Oklahoma.

BUSINESS OPPORTUNITIES

Delaware Corporations formed and serviced. American Guaranty & Trust Company, P. O. Box 487, Wilmington, Delaware.

Venezuelan Contact

Do you need Venezuelan Contacts, Representations, Surveys or "local know-how," if so write

TEN EYCK HULL

Edificio Galipan Caracas, Venezuela
Cable: CALLHULL Telephone: 33-31-45

MONEY RAISING

ADDITIONAL CAPITAL desired to join in purchase of producing oil properties in Oklahoma and Texas. Two properties presently considered. Box L-381, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION WANTED

OIL PRODUCTION WANTED: Adequate engineering information should be available for inspection. Box 31 R 401, The Oil and Gas Journal, 4041 Mariton Ave., Los Angeles 8, Calif.

WANTED: Oil properties. 100 to 5,000 barrels daily in Oklahoma and Kansas. Morris Sitrin, P. O. Box 1160, Tulsa, Okla.

PRODUCTION FOR SALE

SOME SHALLOW OIL wells in Linn County Kans. Ready for water flood. Can be bought at a bargain. Box 793, Pittsburg, Kans.

BUSINESS OPPORTUNITIES

OIL FIELD ENGINE BUSINESS, four corners, three major engine lines, substantial industrial jobber accounts. Will lease or sell building. Mountain climate, trout fishing ten minutes away, big game hunting. Excellent potential. Will sell outright or controlling interest. P. O. Box 1636, Farmington, New Mexico.

FINANCIAL CONTACTS, Underwriters, Private Brokers reached. No shopping. Confidential. Send details to Consultant—817—81st Street, Brooklyn, N. Y.

OIL CORPORATION FOR SALE

Controlling a lease of 280 acres of potential oil land in Fergus County, Montana. Have stopped drilling well at approximately 1,000 ft. due to lack of funds. Will sell at ???-plus royalty basis. Buyer must have funds to complete drilling. (Additional 1,700 acres can be made available for lease). For further information, contact: Napoleon G. Plato, 9400 Washington Blvd., Culver City, Calif. Phone HOllywood 5-4931.

NEW PRODUCTS WANTED—Well-established, responsible company with complete facilities for developing, manufacturing and marketing oil field equipment is seeking new or improved products, preferably patented or patentable, to add to its presently well-known line. Royalty basis or outright purchase. Initial submission should identify engineering and confidential detail. Submissions will be handled promptly and confidentially. Box K-994, The Oil and Gas Journal, Tulsa, Oklahoma.

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Circulation Department

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Box 1260 Tulsa 1, Okla.

LEGAL

SEALED BIDS will be received until June 30, 1959, 2:00 P.M., Central Standard Time, and opened at that time in the Office of the Superintendent, Cheyenne River Indian Agency, Cheyenne Agency, South Dakota, for the leasing of 18,150.53 acres of Tribal land and 9,615.19 acres of Allotted Indian land, located in Townships 14, 15 and 16 North, Ranges 17 and 18 East, of the Black Hills Meridian, Ziebach County, South Dakota, for oil and gas mining purposes. The details of the lease offering and how where to file bids may be obtained by addressing the inquiry to the Superintendent, Cheyenne River Indian Agency, Cheyenne Agency, South Dakota.

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in this issue

A

Air-Maze Corporation 56
Aldrich Pump Company, The 18

B

Baker Oil Tools, Inc. 77
Bendix Aviation Corporation 20
Bethlehem Steel Company
Supply Division 50
Bovaird Supply Co., The 1
Braden Winch Company 134

C

Cabot Shops, Inc. ..... Inside Back Cover
Cameron Iron Works, Inc. 136
Caterpillar Tractor Co. 84
CB/Southern, Inc. 122, 123
Chiksan Company 4
Classified Advertising ... 171, 172, 173, 174
Colorado Fuel and Iron Corp. 40
Continental-Emsco Company, a Division of the Youngstown Sheet and
Tube Company 13, 14, 15, 16
Cook Company, C. Lee 28
Cooper, Inc., Fred E. 54
Crane Co. 101
Crose Manufacturing Co., Inc., M. J. 121

D

Davison Chemical Division of W. R.
Grace & Co. 23
Deming Company, The 33
Dowell 52, 53
Dresser Manufacturing Division 58

E

Enardo Manufacturing Company 156
Evinrude Motors Division of Outboard,
Marine & Mfg. Co. 138

F

Fairbanks, Morse & Co. 157
Fairchild Camera and Instrument
Corporation 55
Fiese & Firstenberger Mfg., Inc. 126
Foxboro Company, The 39
Franks Division of Cabot Shops, Inc. 10, 11

G

Goodrich Chemical Company, B. F.
(Hycar) 7
Goulds Pumps, Inc. 41
Grace & Co., W. R.
Davison Chemical Division 23

H

H & M Pipe Beveling Machine Co. ... 124
Halliburton Oil Well Cementing
Co. ..... Inside Front Cover, 8, 9
Harvey & Co., Ltd., G. A. 38
Homco 144
Huey & Co., S. E. 124
Hughes Tool Co. ..... Back Cover
Humble Oil & Refining Co. 22
Hunt Tool Company 139
Hycalog, Inc. 51

I

Jones & Laughlin Supply Division ... 34, 35

L

Larkin Packer Company, Inc. 135
Lone Star Cement Corporation 64
Lukens Steel Company 60

M

Marsh Instrument Co. 32
Mid-Continent Supply Company 24
Minerals & Chemicals Corporation of
America 30
Mission Mfg. Company 119
Moore Corporation, Lee C. 111
Morgan Stanley & Co. 161

N

Nalco Chemical Company 114, 115
National Supply Co., The 43, 44, 45, 46
National Tank Company 176

O

Odex Engineering Company 155
Oil Center Tool Co. 21
Oil Well Supply Division 6

P

Panoil Company 161
Parkersburg Rig & Reel Co. 27
Petroleum Distributing Co. 133
Petroleum Electric Power Assn. 42
Polyken Sales Division of The
Kendall Company 47
Porter Company, Inc., H. K.—
Thermoid Division 57
Process Operators, Inc. 124

R

Ridge Tool Company, The 126
Roebling's Sons Company, John A. ... 146
Rohm & Haas Company 112, 113
Rolo Manufacturing Company 50
Rust-Oleum Corporation 17

S

Schlumberger Well Surveying Corp. ... 143
Scott-Rice Company 156
Square D Company 59
Stewart & Stevenson Services, Inc. ... 48
Sunshine Iron Works 154

T

Taylor Instrument Companies 36
Texas Employers Insurance Association 12
Thermoid Division of H. K. Porter
Company, Inc. 57
Thornhill-Craver Co. 29
Timken Roller Bearing Company—
Steel and Tube Division 19

U

United States Rubber Company 5
United States Steel Corporation—
Oil Well Supply Division 6

W

Wagner Electric Corporation 49
Wall Colmonoy Corporation 56
Warren Petroleum Corporation 62
Well Equipment Mfg. Corp. 31
Well Instrument Developing Co. 156
Westinghouse Electric Corp. 37
Wichtex Machinery Company 137
Wilson Supply Company 130
Wolverine Tube Division of Calumet &
Hecla, Inc. 25, 26

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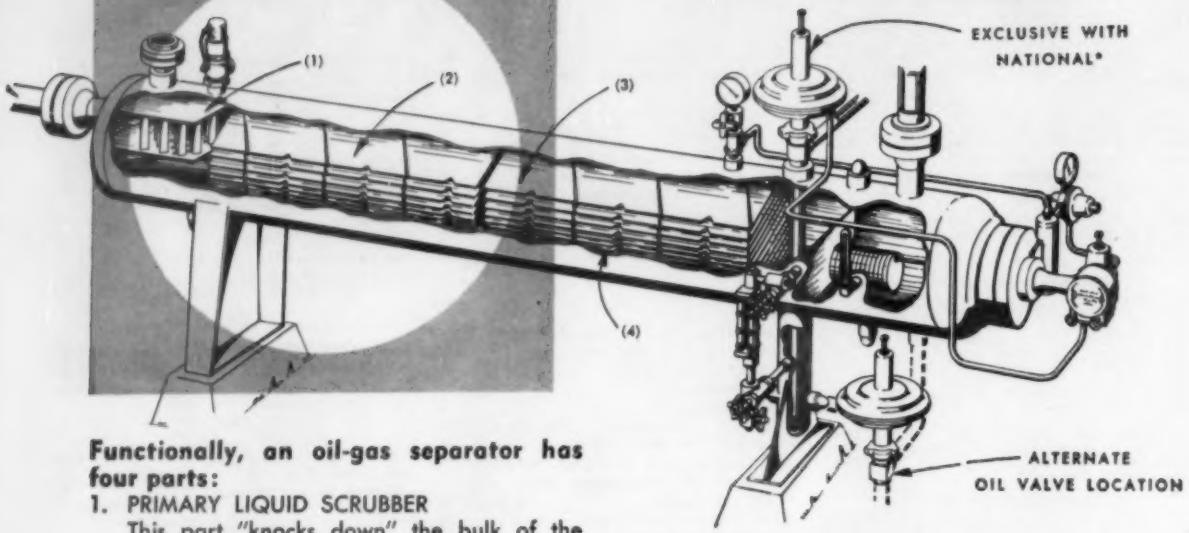
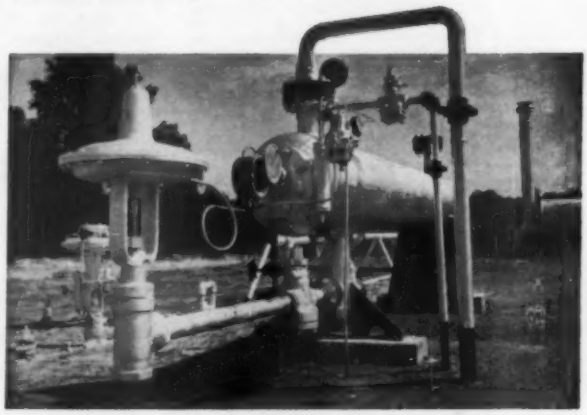


Functionally, an oil-gas separator has four parts:

1. PRIMARY LIQUID SCRUBBER
   This part "knocks down" the bulk of the liquid and removes it from the flowing gas stream immediately.
   National's present design is the result of field tests using full scale operational models which utilized numerous scrubbing elements. From these tests National's present design was found. Today, when you buy a National MONOTUBE Separator, you buy experience, not experimentation.
2. MAIN GAS SCRUBBER
   Also as a result of these tests, proper spacing and length of Main Gas Scrubber plates was discovered, so as to effect the greatest liquid removal from the gas stream.
3. FINAL GAS SCRUBBING
   The multiple field tests with flanged components dictated our design. National's "straight-vane" design accomplishes final liquid removal without the use of "excelsior-like" elements which are prone to be plugged with waxes, sands and other extraneous materials, including hydrates inherent in the normal oil-gas and distillate production operations.
4. OIL DE-GASSING COMPARTMENT
   What effects oil de-gassing? (a) Length of time in compartment. (b) Surface area of oil body. (c) Scrubbing surfaces to remove entrained gases. When (a), (b) and (c) are at a maximum, oil de-gassing is best. National's full-scale field testing found the proper ratios.



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